Using Energy Dispersive X-ray Spectrometry to Analyze & Compare Contamination and Transference on Final Test Sockets

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Virtual Event • May 11-13, 2020

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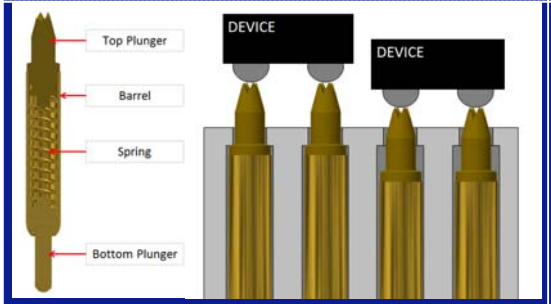
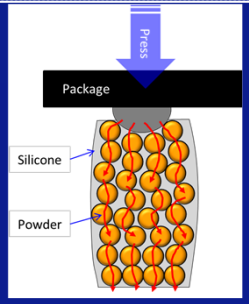
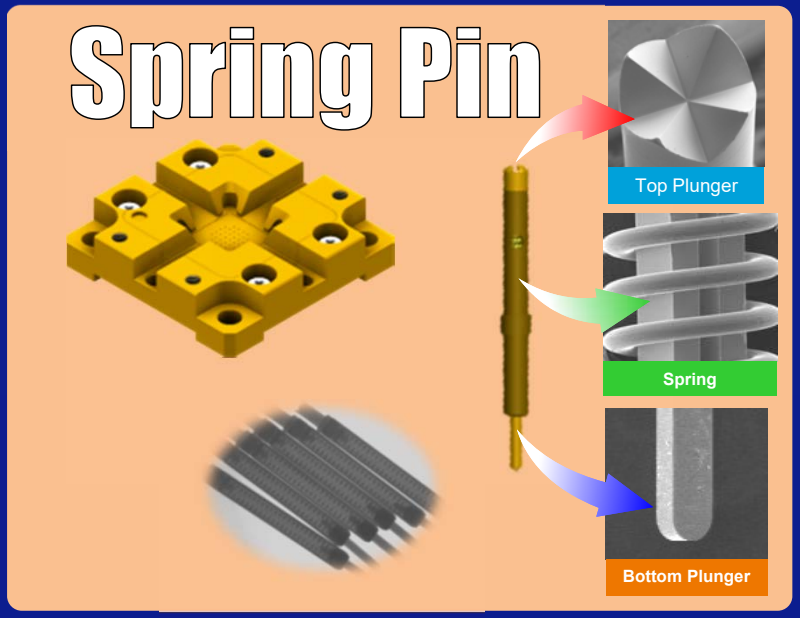
Challenge : Determine Source and Quantity of Contamination on Spring Pin Socket & Elastomer Socket

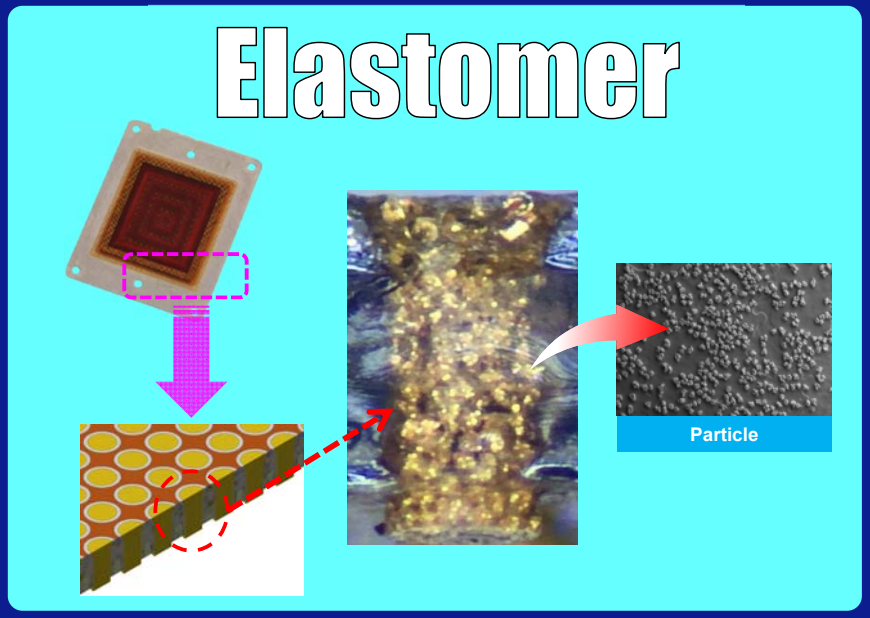
- *Type of the Test Socket*

	Spring Pin Socket	Elastomer Socket
Parts	Spring, Barrel, Plunger, Housing	Silicone Rubber, Powder, Frame
Contact Point	Plunger (machining)	Powder (atomizing)
Motion Section	Spring	Silicone
Structure		

Challenge : Determine Source and Quantity of Contamination on Spring Pin Socket & Elastomer Socket

- *Spring Pin Socket has Plunger and Spring, Elastomer has Particle*





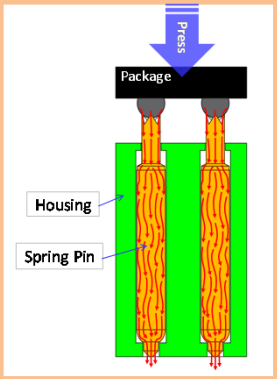
Challenge : Determine Source and Quantity of Contamination on Spring Pin Socket & Elastomer Socket

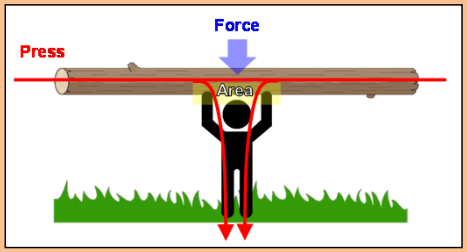
- *Elastomer Socket has Pressure Distribution and Wide Contact Area*

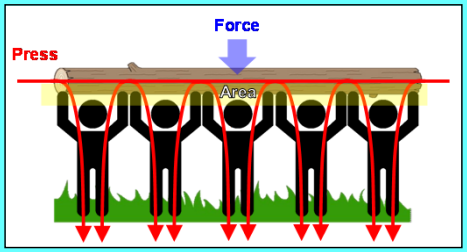
Spring Pin

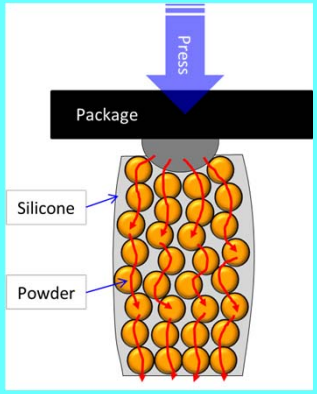
Elastomer

$$\text{(Pressure) } P = \frac{F \text{ (Force)}}{A \text{ (Area)}}$$





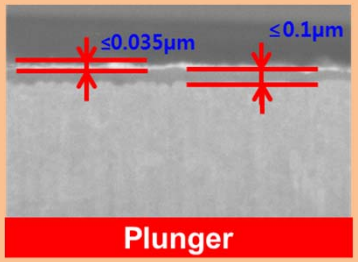




Challenge : Determine Source and Quantity of Contamination on Spring Pin Socket & Elastomer Socket

- *Elastomer Socket has Thick Plated Layer than Spring Pin Socket*

Spring Pin

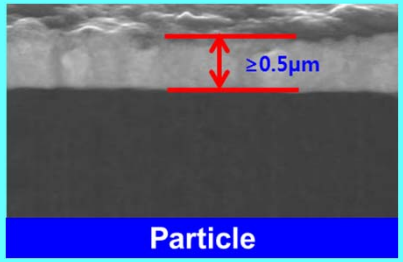


Plating layer

Electrical Performance UP

Prevent Oxidation UP

Elastomer

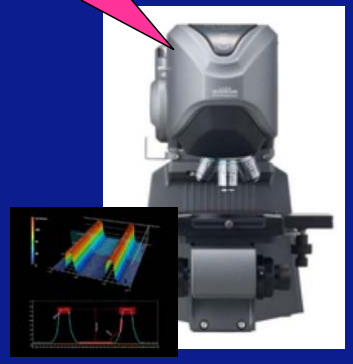


Inspection & Analysis Equipment

Magnification : 0.67x ~ 4.5x
Zoom Ratio : 6.7 : 1

< Microscope >

Resolution : 0.5nm (Height),
1nm (Width)
Magnification : Up to 28,800x
Scan Speed : 4 ~ 125Hz
Light Source : Violet semiconductor laser, 404 nm



< 3D Profiler >

SEM
Resolution : 3nm at 30kV
Accelerating Voltage : 0.5kV ~ 30kV
Magnification : 5x ~ 300,000x

EDS
Acceleration Voltage : 500V ~ 20kV

< SEM with EDS >

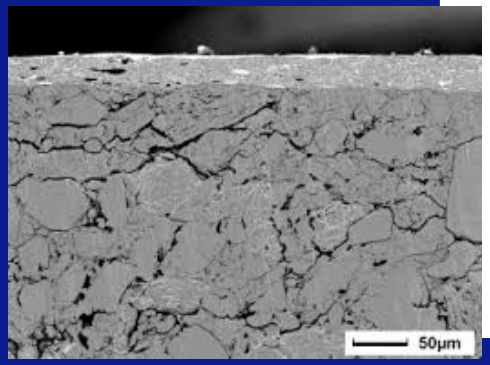
Ion Acceleration Voltage : 2 ~ 8kV
Ion Beam Width : about 500μm (If 8kV, Si sample)
Milling Speed : 500μm / hour (If 8kV, Si sample)
Milling Gas : Argon

< Cross Section Polisher >

TestConX™ Using Energy Dispersive X-ray Spectrometry to Analyze & Compare Contamination and Transference on Final Test Sockets 7 2020

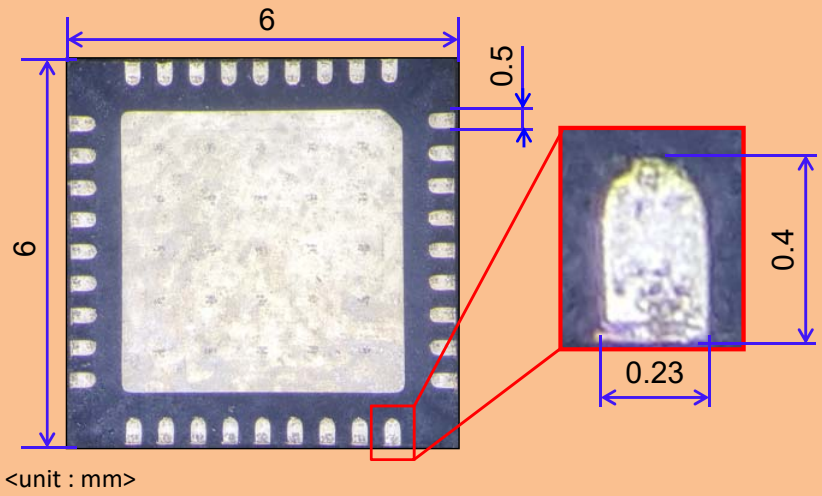
Set-up of Energy Dispersive X-ray Spectrometry

- Tester : JEOL Inc. JSM-IT500
- Set-up
  - ✓ Landing Voltage : 15kV
  - ✓ Focus(WD) : 10.0 mm
  - ✓ Vacuum Mode : High Vacuum
  - ✓ Quantification Method : ZAF



Comparison Evaluation Conditions

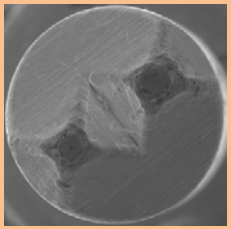
PACKAGE INFORMATION

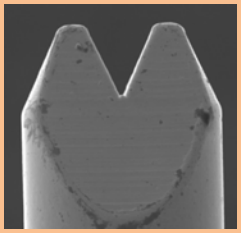


Device Information	
Package	36QFN(6X6_0.5P)
Device	PMIC
Max Test Speed	3.6 MHz
Pad Material	Sn
Max Test Current	Max 2A
Test Temperature	Room, 105°C, -40°C
Tester	ETS364
Handler	Seiko Epson

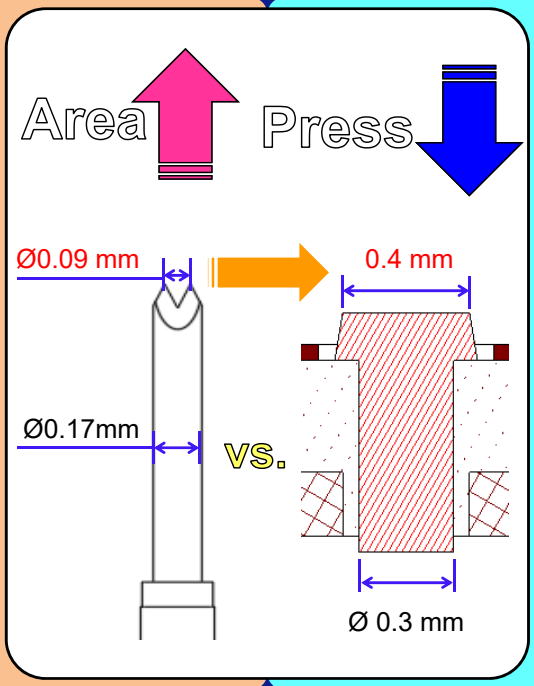
Comparison Evaluation Conditions

Spring Pin





Socket Height	4.95 mm
Force Per Contact	20gf±20% @ 0.5 mm Travel
Operation Temperature	- 40℃ ~ + 125℃



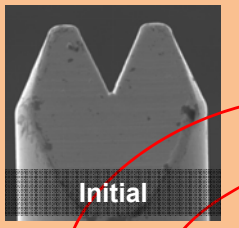
Elastomer

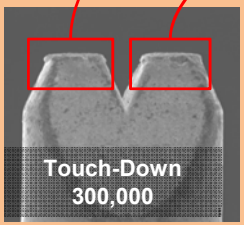
Socket Height	0.75 mm
Force Per Contact	**20gf±20% @ 0.2 mm Travel**
Operation Temperature	**- 40℃ ~ + 125℃**

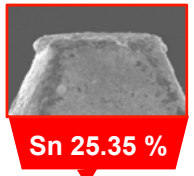
Results & Analysis

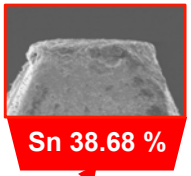
- *Contact Point*

Spring Pin

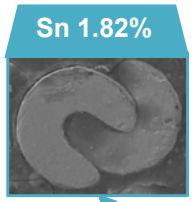


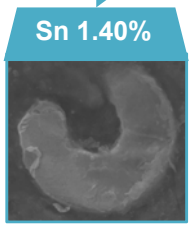


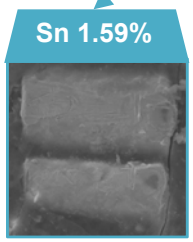




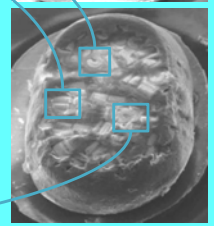
VS.







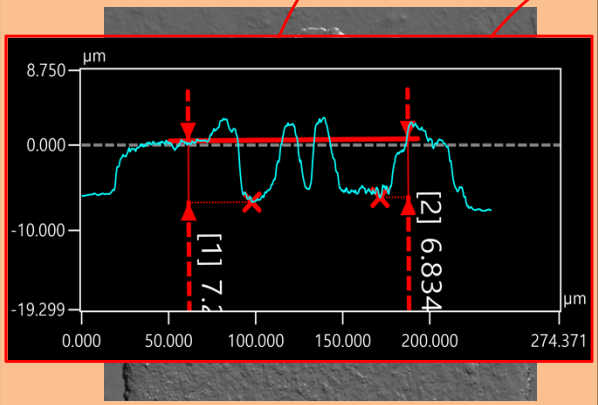
Elastomer



Results & Analysis

- *Contact Marks for Package*

Spring Pin

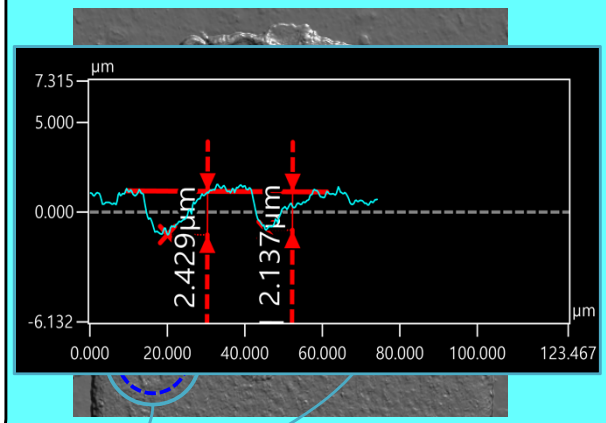


	Sample #1	Sample #2
Depth	7.24 um	6.83 um
Debris Height	2.73 um	1.90 um
Area	536.52 um²	507.85um²

VS.

	Sample #1	Sample #2
Depth	2.43 um	2.14 um
Debris Height	0.48 um	0.36 um

Elastomer



Results & Analysis

- *Contact Marks for Board*

Spring Pin

RIGID TYPE

Elastomer

Results & Analysis

- *Customer Production Status*

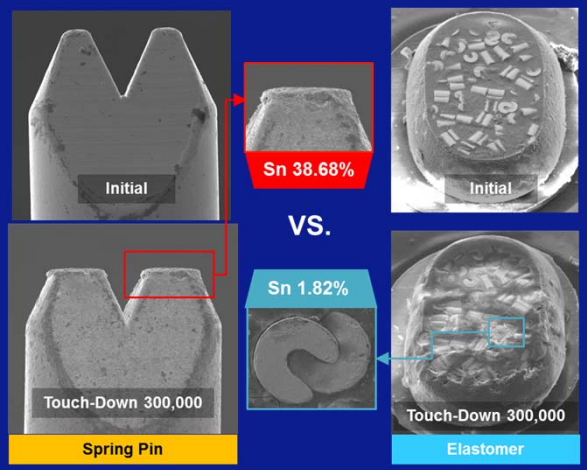
Jan. 17, 2020

PKG	DUT Count/ Test Temp.	Pad material	Spring Pin (Life Cycle / Cleaning)	Elastomer Socket (Life Cycle / Cleaning)
5△ QFN	Single / Ambient	Matte Sn	(100K / 10K)	(400K No Cleaning)
3△ QFN	Quad / Hot & Cold	Matte Sn	(10K / 1K)	(50K No Cleaning)
2△ QFN	Quad / Hot	NiPd	(80K / 10K)	(150K No Cleaning) (Evaluation Cout..)
△8 QFN	Quad / Ambient	Matte Sn	(200K / 10K)	(320K No Cleaning)

Comparison of Results : Spring Pin vs. Elastomer

- ***Contact Point***

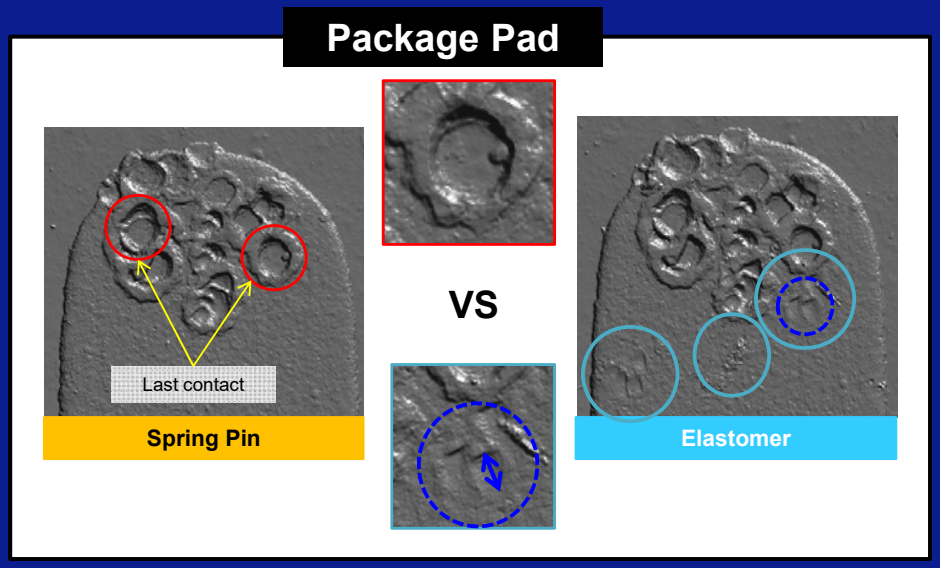
  ✓ Spring Pin Socket is likely to occur excessive Sn contamination and damage to the pin contacts

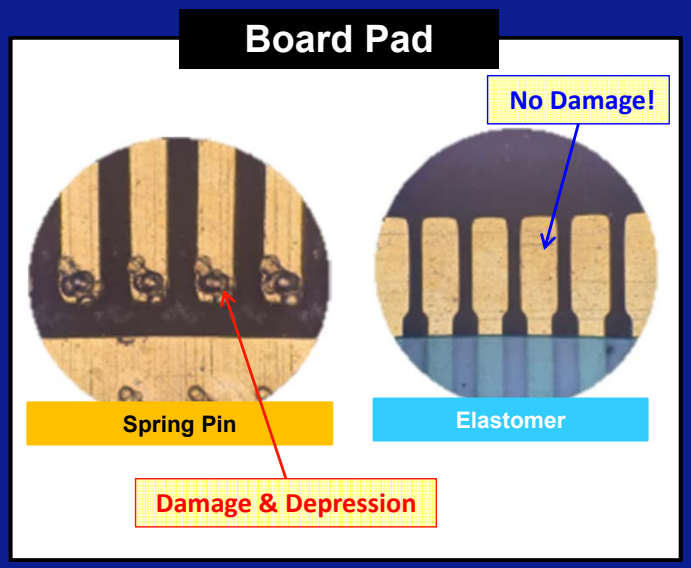


Comparison of Results : Spring Pin vs. Elastomer

- ***Contact Mark***

  ✓The contact mark and damage of the Elastomer is smaller than Spring Pin Socket





Summary

- ***Contact Point***
  - ✓ Elastomer Socket has less Sn contamination and low contact point consumption compare to Spring Pin Socket because of thick plating layer and pressure distribution
- ***Contact Mark***
  - ✓ Elastomer Socket has less damage in Package Pad & Board Pad compare to Spring Pin Socket because of pressure distribution

Conclusion

- *The Spring Pin Socket is likely to occur excessive Sn contamination and damage to the pin contacts*
  - ➔The Spring Pin Socket requires continuous cleaning due to excessive Sn contamination
  - ➔Short replacement cycle due to pin contact area damage
- *The damage of Package Pad and Board is less than Spring Pin Socket*
  - ➔Cleaning cycle is long and contact damage is small

Package	DUT Count/ Test Temp.	Pad material	Spring Pin Socket (Life Cycle / Cleaning)	Elastomer Socket (Life Cycle / Cleaning)
5△ QFN	Single / Ambient	Matte Sn	(100K / 10K)	(400K / No Cleaning)

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