

## **BETTER BY DESIGN**

The greatest results always begin with a good design. In the world of test and burn-in, the variations are endless. That's why this session features a broad assortment of design topics and perspectives. Beyond socket design, we'll learn about designing the right handler for the job. Next is a birds-eye view of a socket's creation from design concept to final assembly, followed by a specific look at designs and applications for package-on-package (PoP) device testing.

### **A Novel Nested Doll Concept in Universal Kit for Test Handler**

Yee Wei Tiang—Intel (Malaysia)

### **Anatomy of a Socket**

Paul F. Ruo—Aries Electronics, Inc.

### **Special Designs and Applications for PoP Device Testing**

Siang Soh, Frank Zhou, Jon Diller, James Spooner, Khaled Elmadbouly  
—Interconnect Devices, Inc.



This Paper

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# Anatomy of a Socket

**Paul F. Ruo**  
**Aries Electronics, Inc.**



2013 BiTS Workshop  
March 3 - 6, 2013

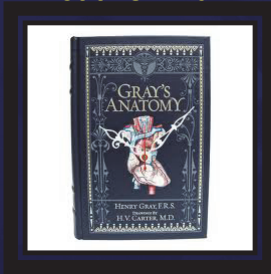


## Content

- **Welcome**
- **Types of Sockets** (For this discussion)
- **Contact Systems & Components** (Just the basics)
- **Assembly** (Why they can cost so much)
- **Quoting & Buying Sockets** (How to make the process easy!)

## What Kind of Anatomy?

Not this kind



Or even this kind

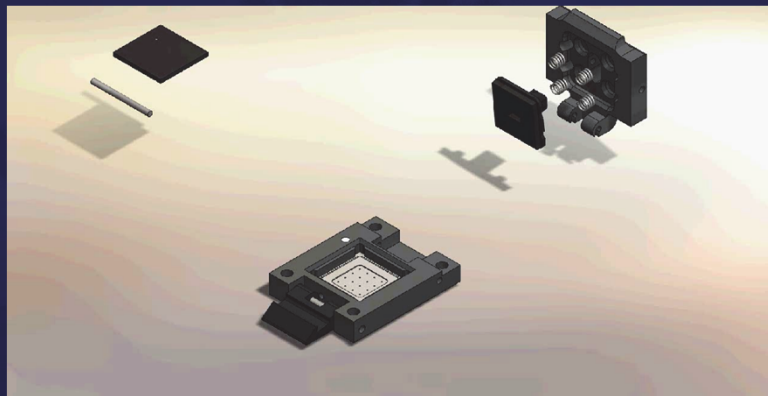


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## This Kind of Anatomy



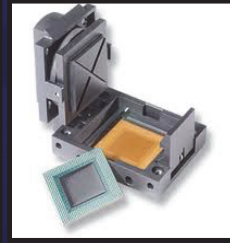
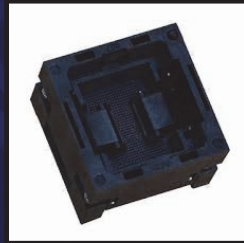
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## Types of Sockets

### Burn-in Sockets



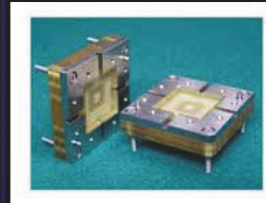
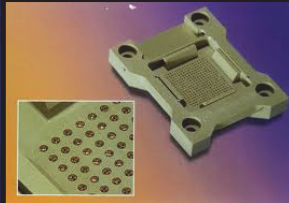
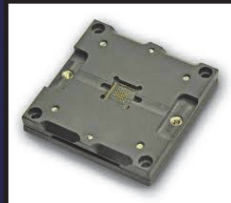
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## Types of Sockets

### Test Sockets



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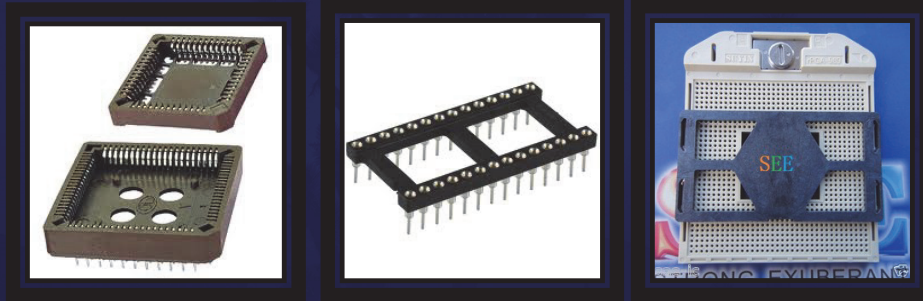
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## Types of Sockets

### Production Sockets



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## Types of Contact Systems

### Turned Spring Probe (Pogo Type)



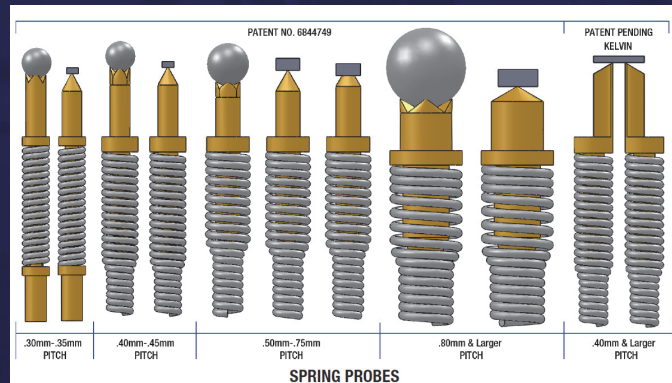
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## Types of Contact Systems

### Turned Spring Probe (2-Piece Type)



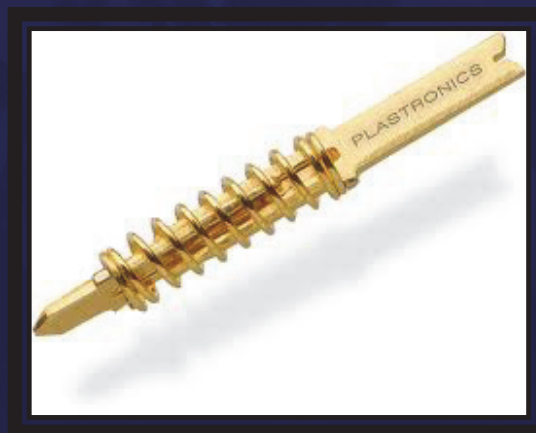
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## Types of Contact Systems

### Stamped Spring Probe (2-Piece Type)



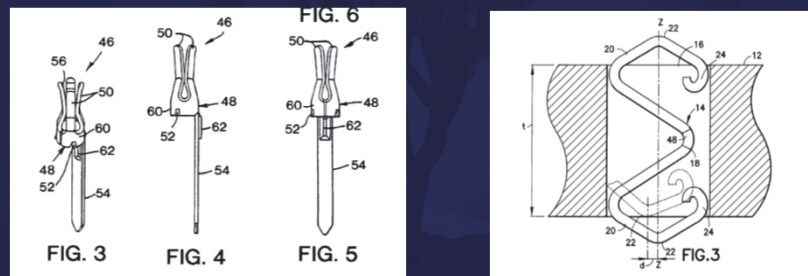
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## Types of Contact Systems

### Stamped Contact (T/H or SMT)



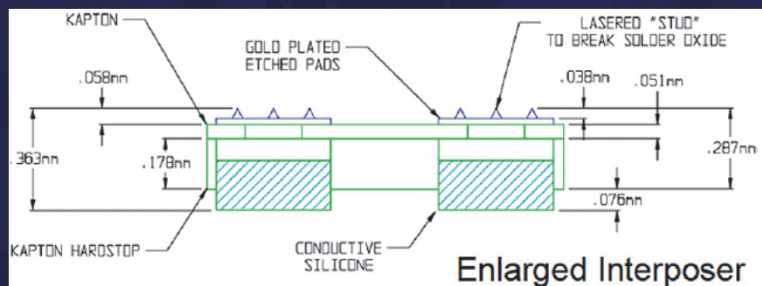
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## Types of Contact Systems

### Conductive Elastomer Contacts



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## Socket Components Moldings and Machinings

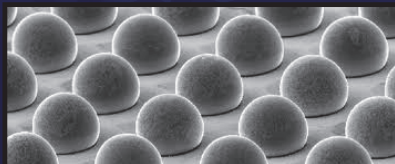


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## Socket Components Contact Material



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## Socket Components



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## Socket Components: Moldings

1. Make the Mold
2. Start with metal & an EDM



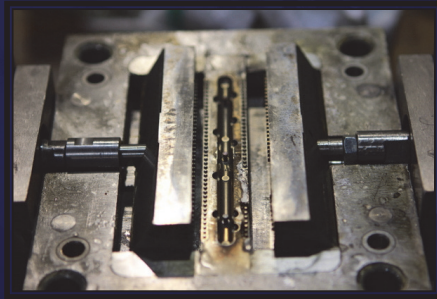
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## Socket Components: Moldings

- This will give you a basic mold



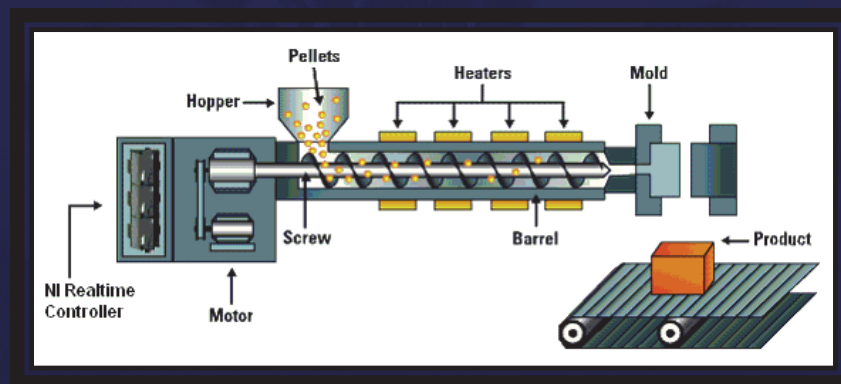
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## Socket Components: Moldings

- Injection Molding



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## Socket Components: Moldings

- Injection Molding in Action



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## Socket Components: Moldings

- Make the mold: EDM, Grinding etc.
- Choose plastic resin dependent upon need
- Resin gets heated & injected into mold
- Injection Mold ejects finished parts

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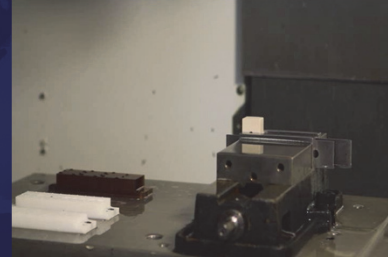
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## Socket Components: Machining

- CNC Machine in Action



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## Socket Components: Machining

- Design parameters in CAD
- Load program data into CNC machine
- Operator loads drills/tools etc. (as needed)
- Operator sets up material into CNC
- Parts are cut/formed by drills/tools
- Parts are lubricated with oil

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## Socket Components: Turnings

- Precision Turned Parts



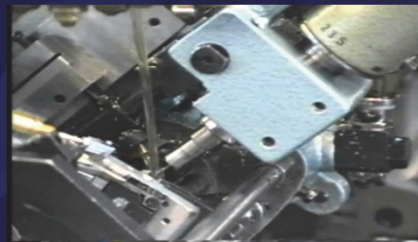
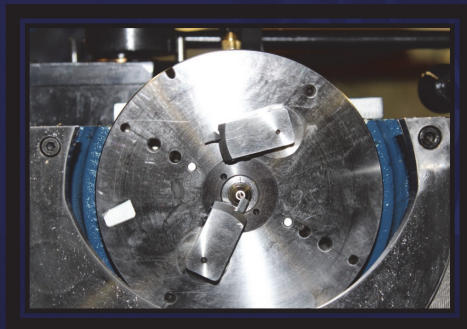
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## Socket Components: Turnings

- Precision Turning Machine in Action



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## Socket Components: Turnings

- Design parameters in CAD
- Load program data into CNC machine or
- Make cams for bar/coil machines
- Cutting is performed by adjustable lathes
- Lathes controlled by cams
- Parts are lubricated with oil

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## Socket Components: Stampings

- Hi-Speed Contact Stampings



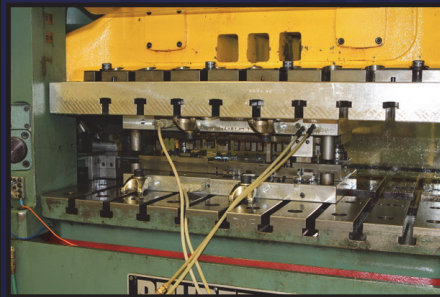
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## Socket Components: Stampings

- Hi-Speed Stamping Press in Action



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## Socket Components: Stampings

- Make die on EDM and finish on grinders
- Load flat stock onto machine
- Stamping cuts shapes and forms metal
- Machine then collects onto reel
- Reel can then be used for auto assembly

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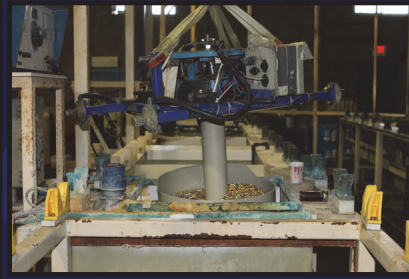
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## Socket Components: Plating

- Electroplating Process



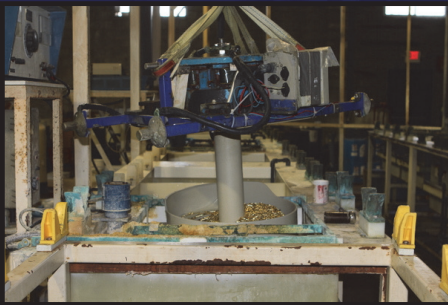
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## Socket Components: Plating

- Vibratory Plating in Action



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## Socket Components: Plating

- Choose your metal depending on need
- Choose your process:
  - Barrel plating for larger parts (>3mm)
  - Vibratory plating for smaller items
- Electric current and an electrolyte solution is used to deposit the plating on the part.
- Parts are then rinsed, cleaned and separated

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## Assembly

- You have chosen your socket type
- You have a machined or molded body
- Contacts have been made and/or plated
- You now can assemble the components

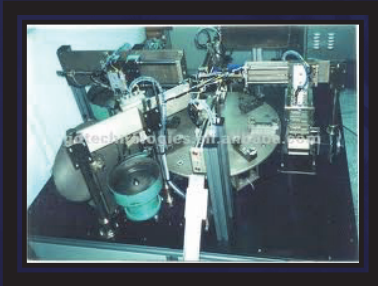
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## Assembly

- Auto assembly is used with many sockets



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## Assembly

- But hand assembly is still widely used



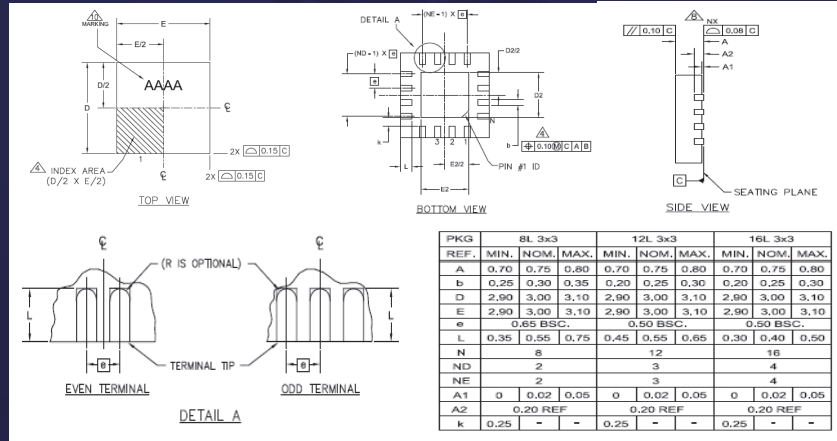
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## Quoting and Buying Sockets

### Send a DETAILED Package Drawing



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## Quoting and Buying Sockets

- Application: B/I, Test, Production?
- Environmental Needs (Temp. Humidity etc.)
- Special applications (Handlers etc.)
- How many pieces do you need?

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## Quoting and Buying Sockets

- Why do some sockets cost so much?
  1. Machined vs. Molded Housing (\$\$\$\$ vs. \$)
  2. Turned/Elastomer vs. Stamped (\$\$\$\$ vs. \$)
  3. Gold vs. Other Platings (\$\$\$\$ vs. \$)
  4. Hand Assembly vs. Machine (\$\$\$\$ vs. \$)

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## Quoting and Buying Sockets

- Delivery work-days for custom sockets?
  1. Machined vs. Molded Housing (10+ / 35+ )
  2. Turned/Elastomer vs. Stamped (20+ / 35+)
  3. Gold vs. Other Platings (3+ / 3+)
  4. Hand Assembly vs. Machine (5+ / 5-30+)

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## Conclusion

- Sockets can be complex and specialized
- CNC housings accelerate delivery
- Numerous contact systems are available
- Sockets CAN be expensive
- Delivery CAN take a long time
- Nothing good is ever easy (or cheap)
- There is no ideal socket (BiT Workshop?)

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## Credits

- Aries Electronics
- Weiss-Aug Co.
- Vibroplating Inc.
- Plastronics

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