



**Burn-in & Test  
Socket Workshop  
2000**

# **Session 6**

# **New Technologies**



## BURN-IN & TEST SOCKET WORKSHOP

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# Presentations

## **“Using MicroSpring™ Contacts As Second Level Interconnect”**

John Novitsky  
FormFactor

## **“A New Burn-in Socket For Fine Pitch BGAs”**

Yuji Wada  
Hitachi Ltd.

Akio Hasebe  
Hitachi Ltd.

Kenichiro Morinaga  
Hitachi Ltd.

Hideo Arima  
Hitachi Ltd.

Hiroyuki Mogi  
Enplas Corporation

Hokuto Kaneshashi  
Enplas Corporation

Tomoaki Soshi  
Enplas Corporation

## **“Novel Contacting Technology For Fine Pitch Leaded & Area Array Devices”**

Frank Bumb  
3M

Ron Revell  
3M

# **A NEW BURN-IN SOCKET FOR FINE PITCH BGAs**

**Yuji Wada , Akio Hasebe , Kenichiro Morinaga  
and Hideo Arima**

**Assembly Technology Development Operation  
Semiconductor Integrated Circuits, Hitachi Ltd.**

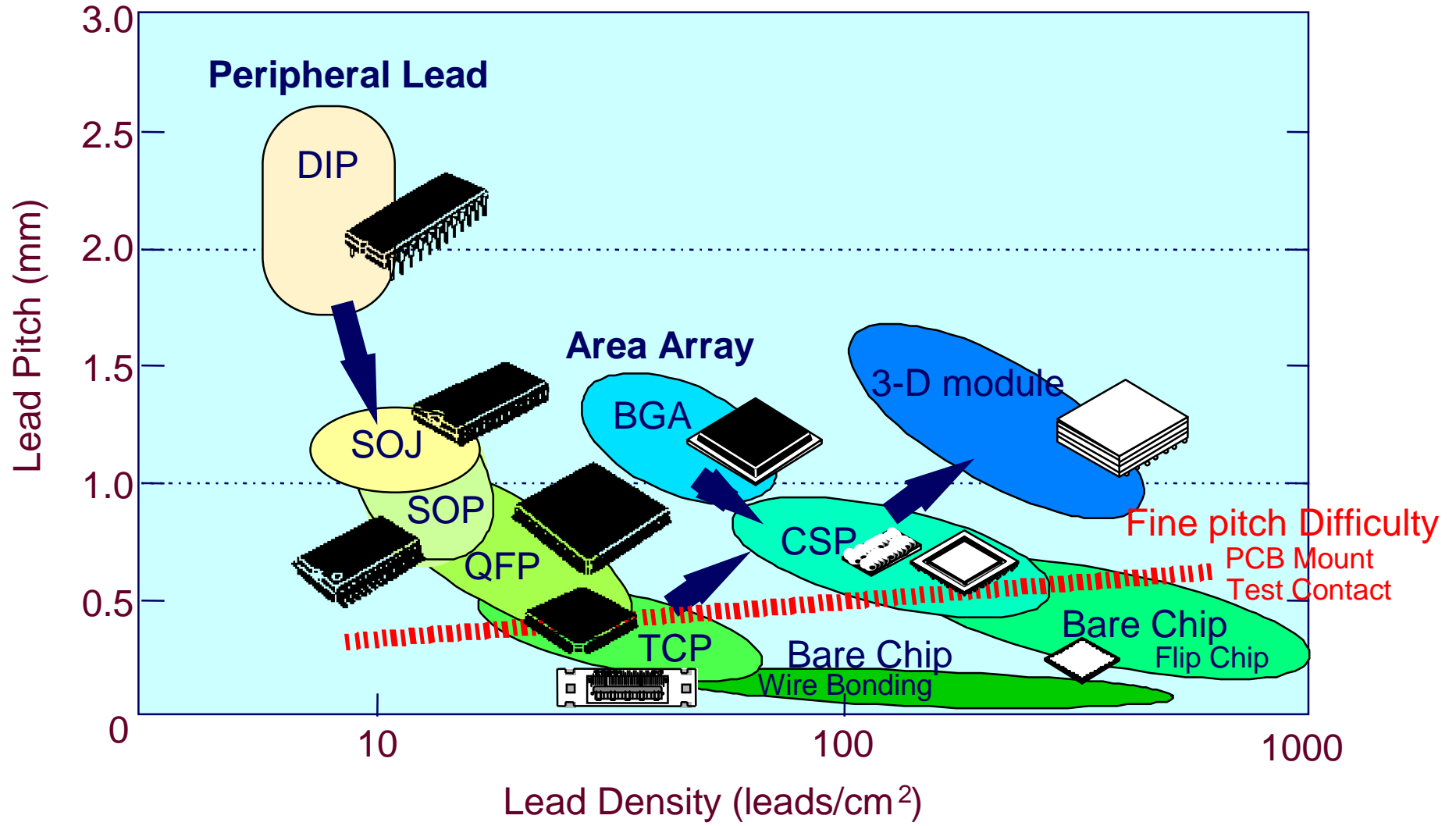
**And**

**Hiroyuki Mogi , Hokuto Kaneshashi Tomoaki Soshi  
Semiconductor Peripherals Div., Enplas Corporation**

# Agenda

- Market Trend
- Technical Issue and Its Countermeasure
- Socket Technology
  - Projected Formed Contact Technology
  - Reduction of Solder Ball Deformation
  - Absorption for Uneven Solder Ball Height
  - Accurate Alignment of Socket Assembly
  - Tape Circuit Fanned-out
- Socket Cost Reduction
- Future Development
- Conclusion

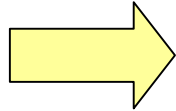
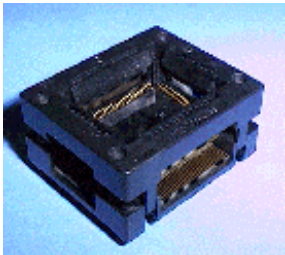
# Market Trend



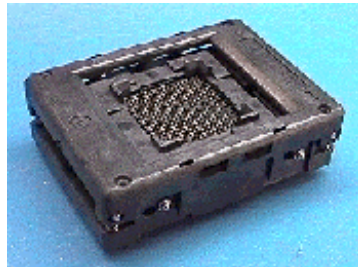
# Market Trend

## LOGIC SOCKET

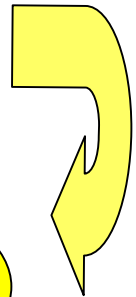
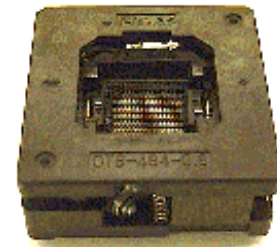
QFP



BGA

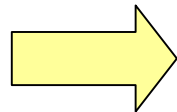
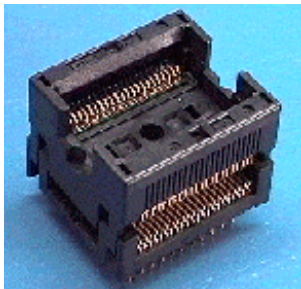


CSP-0.8

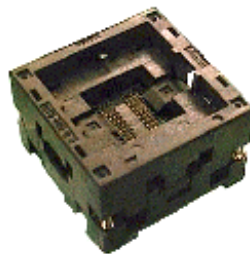


## MEMORY SOCKET

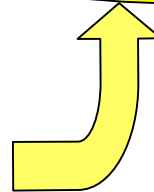
TSOP



CSP-0.8/-0.75

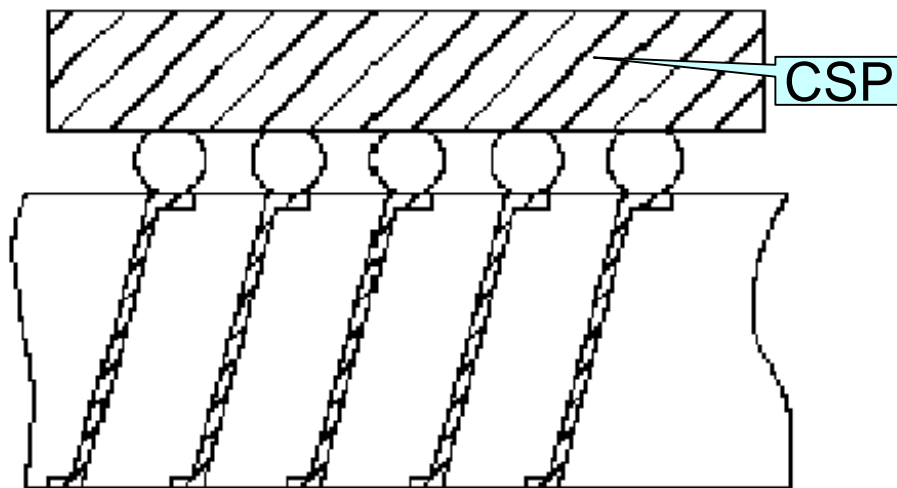


**CSP-0.5mm pitch  
SOCKET**

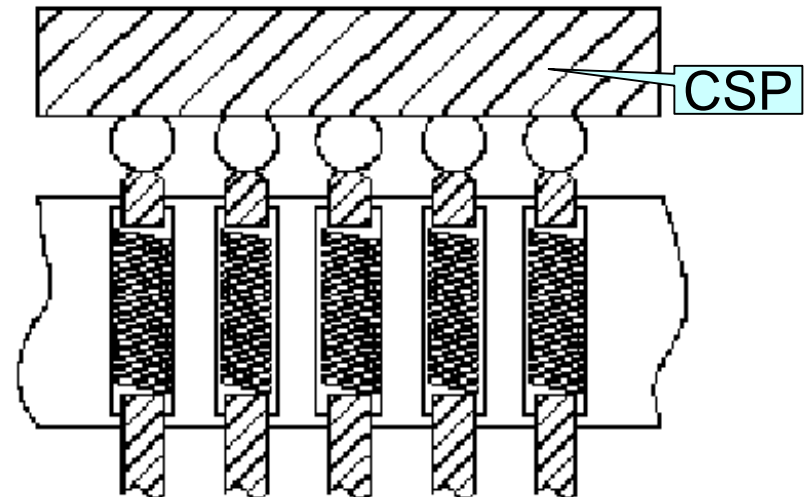


# Market Trend

## Current Socket Design for CSP 0.5 mm Pitch



**Sheet Rubber Type**



**Spring Probe Pin Type**

# Technical Issue and Its Countermeasure

## Technical Issues

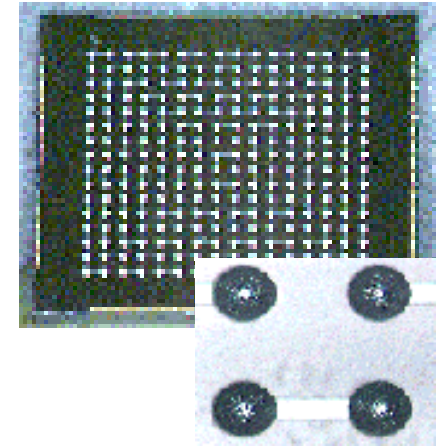
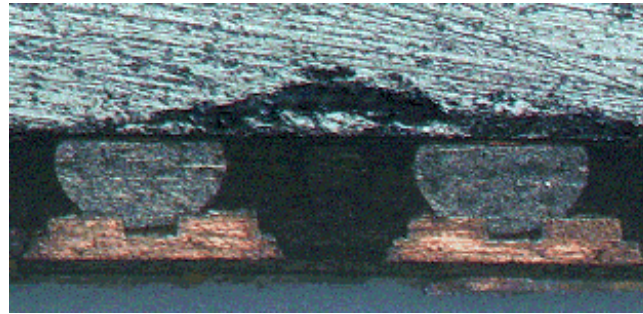
- Reliable & economical contact for less than 0.5 mm pitch is not yet established.
  - Longer Life Cycle after Burn-in (125 deg. C.)
  - Less Solder Ball Deformation after Burn-in (125 deg. C.)
  - Absorption for Uneven Solder Ball Height
  - Accurate Precise Alignment of Socket Assembly
- Difficulty of BIB Design Followed by Package Fine Pitch Tendency

# Technical Issue and Its Countermeasure

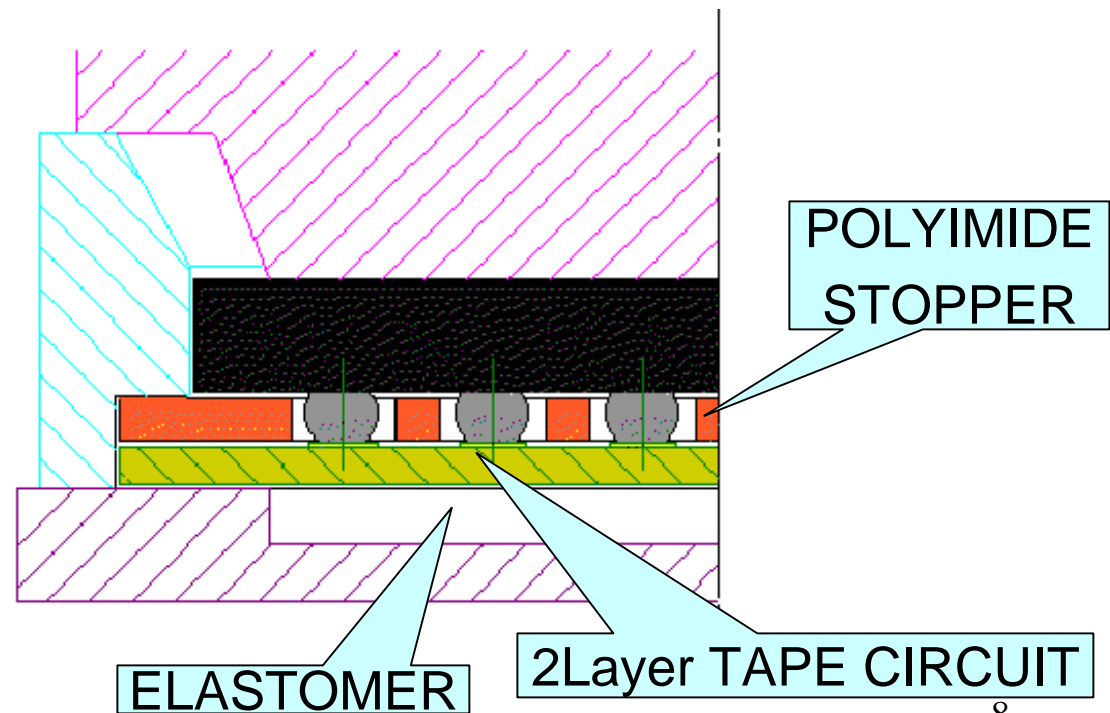
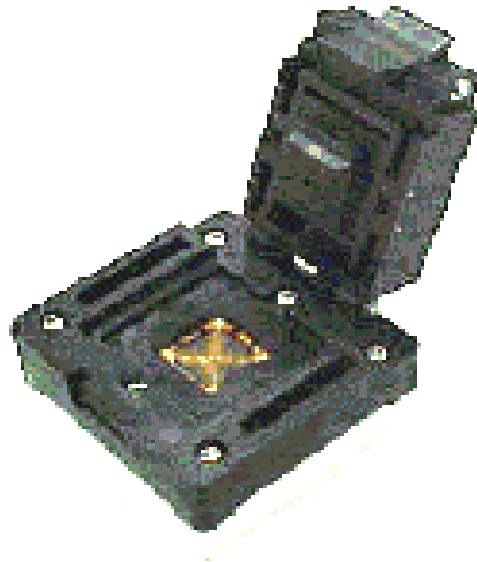
## Countermeasures

- Development of Highly Reliable Contact
  - Projection Formed Contact Technology
    - » Longer Life Cycle
  - Polyimide Stopper
    - » Less Solder Ball Deformation
  - Appropriate Contact Force & Elastomer
    - » Absorption for Uneven Solder Ball Height
  - Multiple Layered Method
    - » Accurate Socket Assembly
- Tape Circuit Fanned-out
  - » Applicable with Current BIB Technology

- 2 Layered Wiring
- Polyimide Stopper
- Elastomer



## Sheet Contact SOCKET



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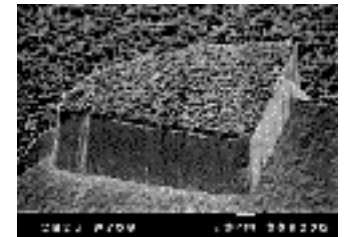
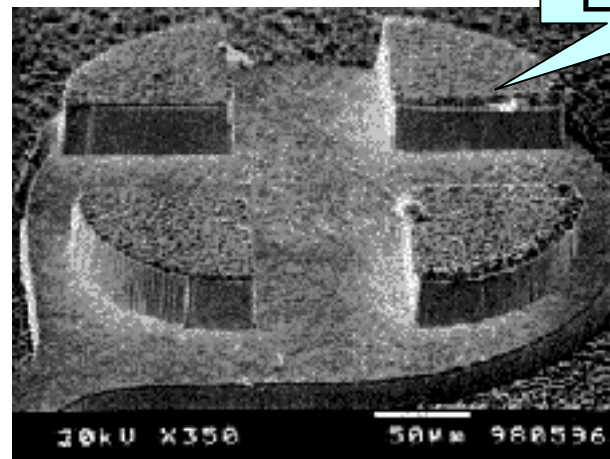
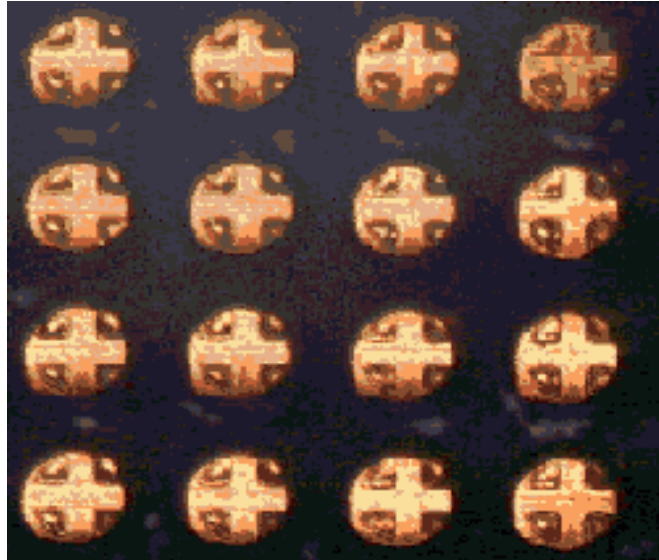
# Socket Technology

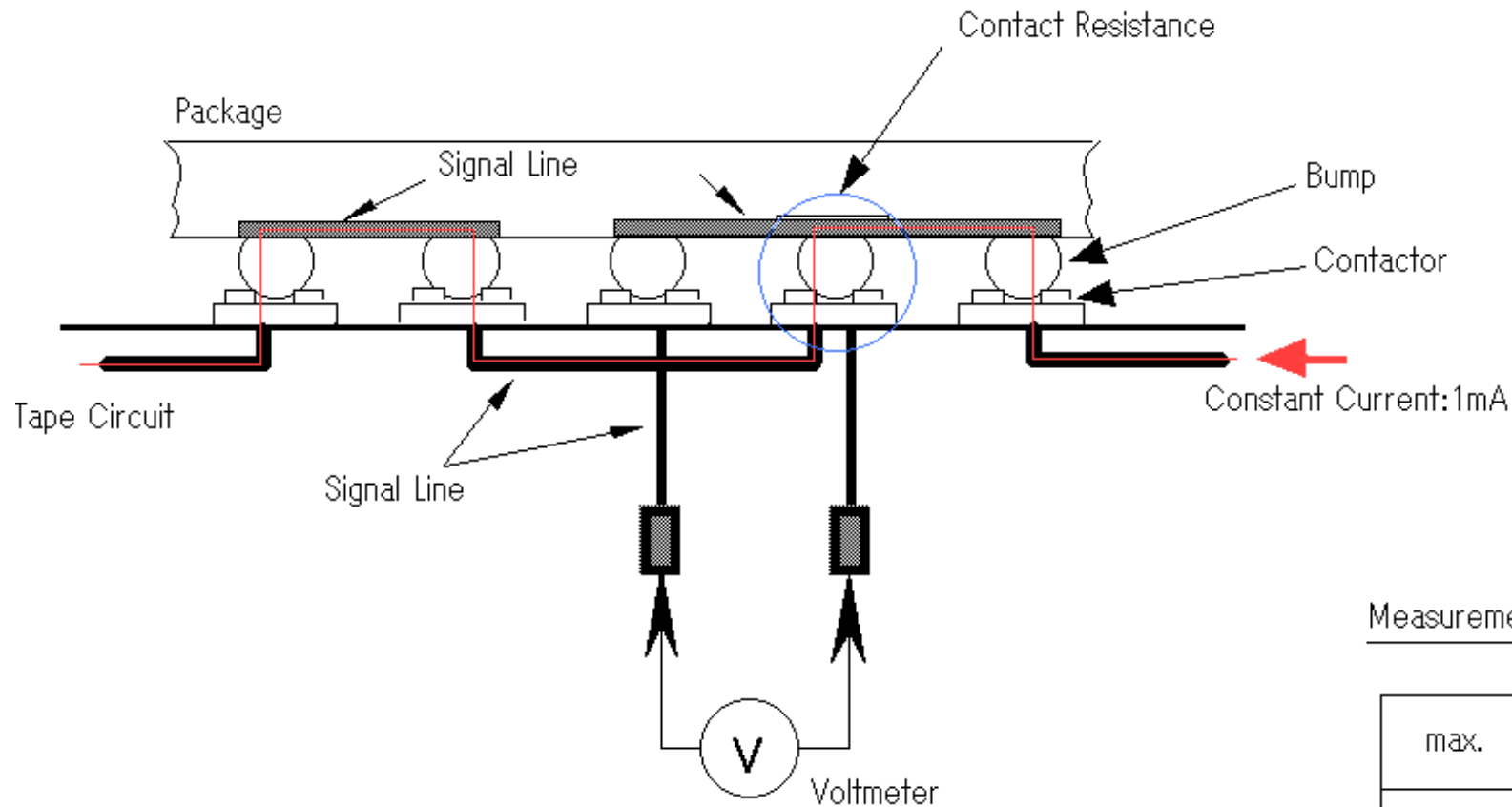
- Projection Formed Contact Technology
- Reduction of Solder Ball Deformation
- Absorption for Uneven Solder Ball Height
- Accurate Alignment on Socket Assembly
- Tape Circuit Fanned-out

# Socket Technology

## Projection Formed Contact Technology

- To Realize Solder Ball Self-alignment
- To Realize Longer Contact Life by Designing Edge Contact
- To Absorb Uneven Solder Ball Height by Increasing and Standardizing Edge Contact Height



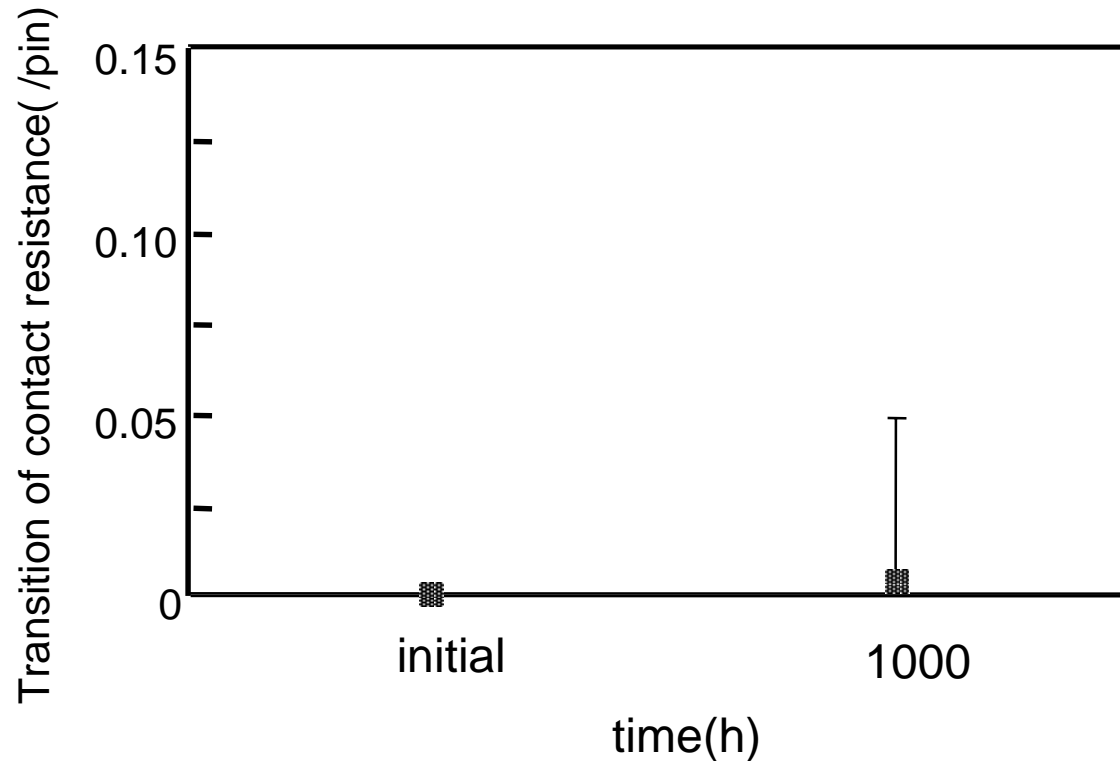


Measurement data

	unit : m $\Omega$
max.	8.5
Ave.	5.44
min.	2.6

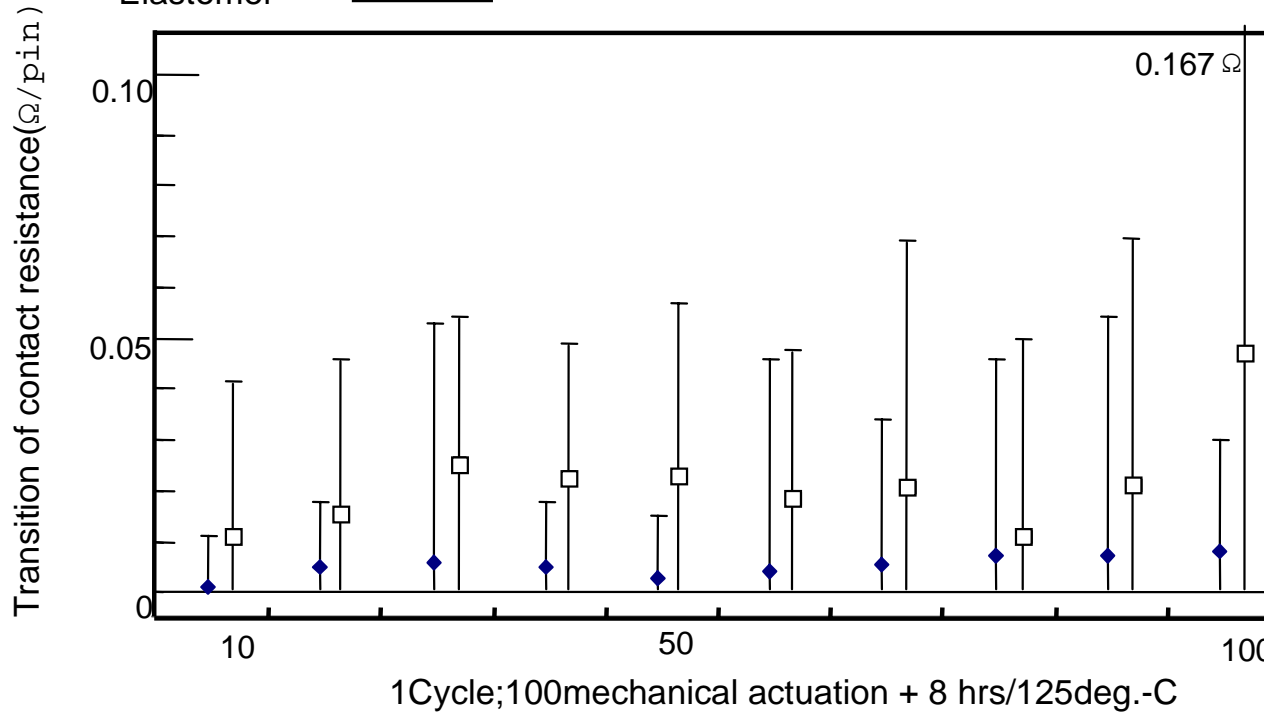
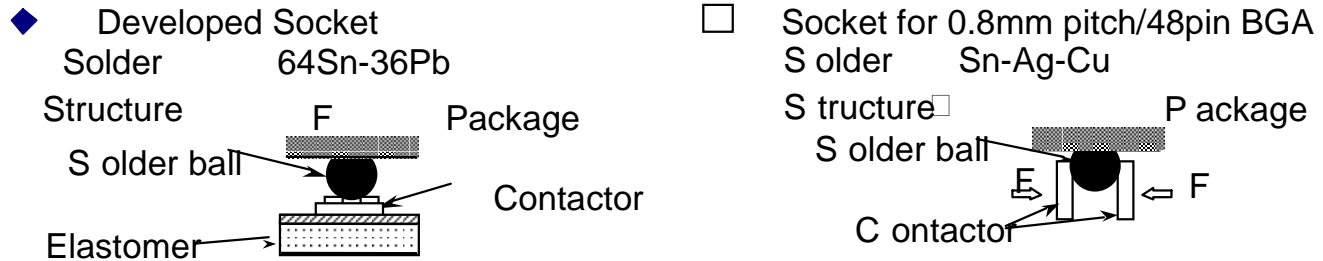
## Principle of 4 probe method

# Socket Technology Engineering Data



Transition of Contact Resistance  
after 125deg.-C for 1000hours

# New Socket Technology Engineering Data

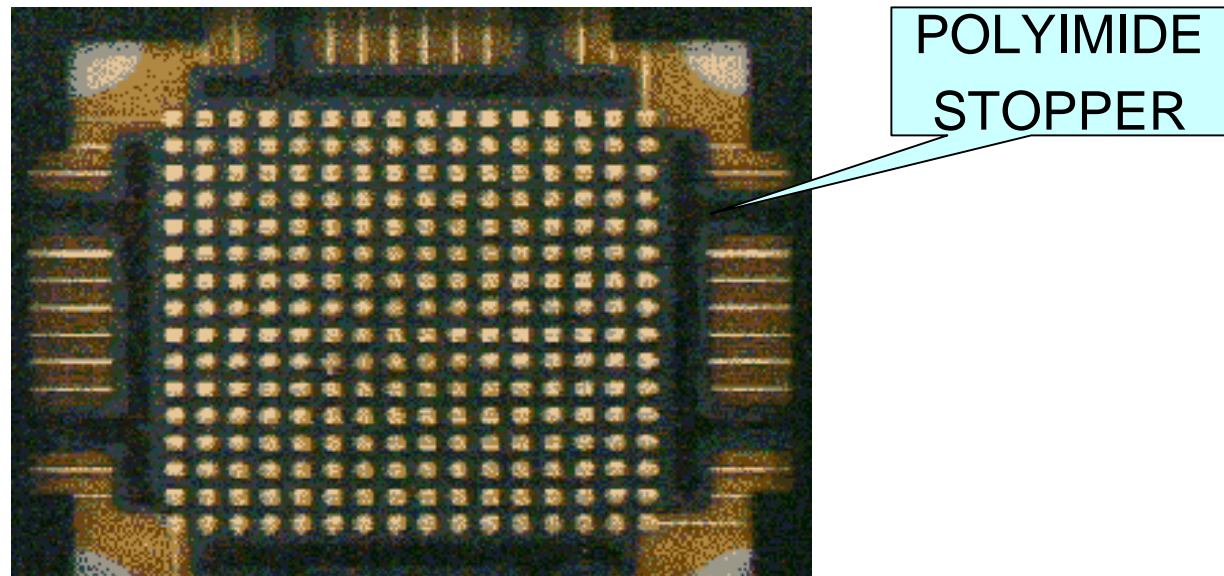


**Result of Evaluation for Contact life time**

# Socket Technology

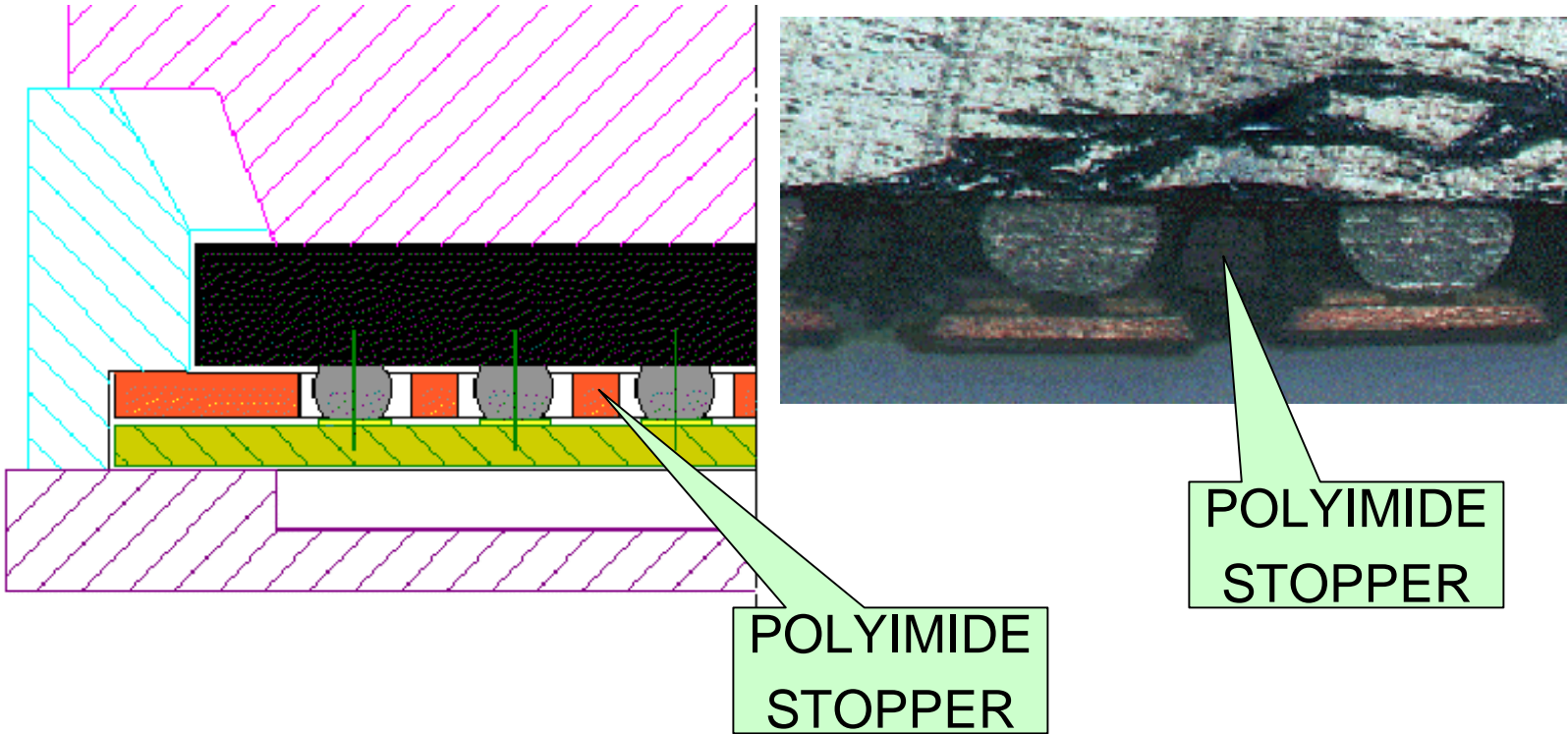
## Reduction of Solder Ball Deformation

- By using polyimide stopper, even Sn/Pb solder ball can be minimized. Pb free solder ball can be more minimized.

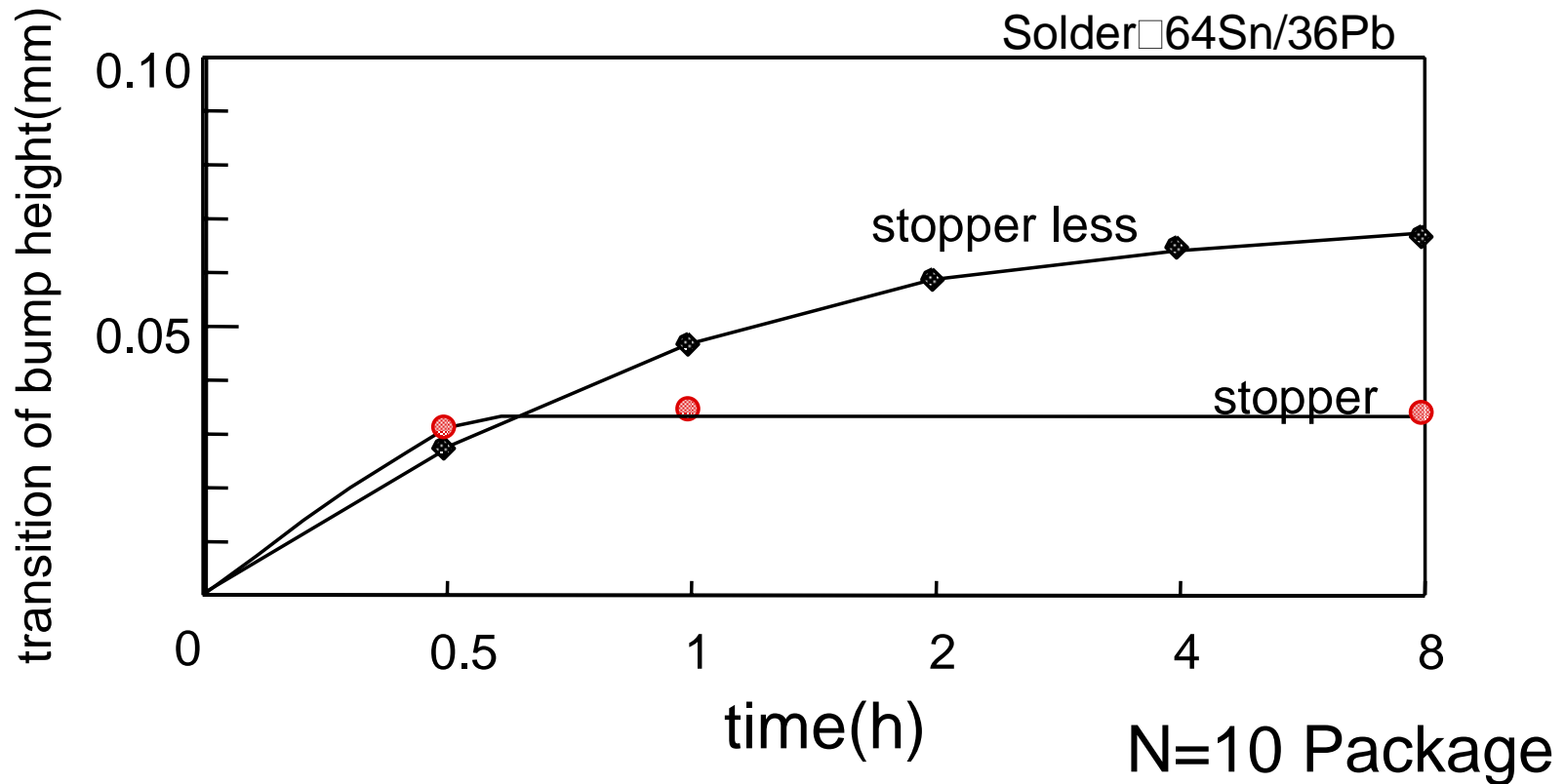


# Socket Technology

## Reduction of Solder Ball Deformation

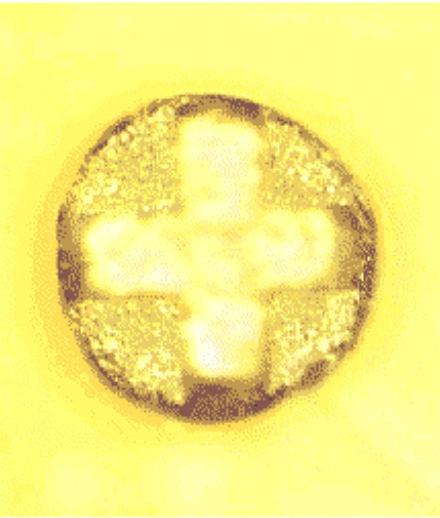
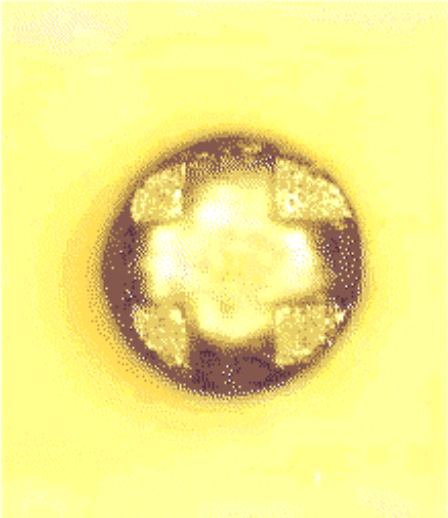
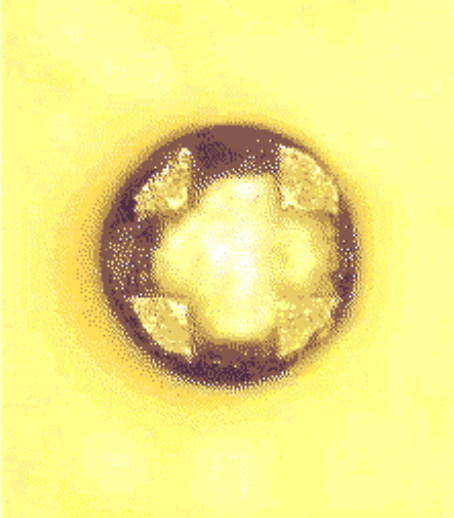


# Transition of bump height Data (w/ and w/o Polyimide Stopper)

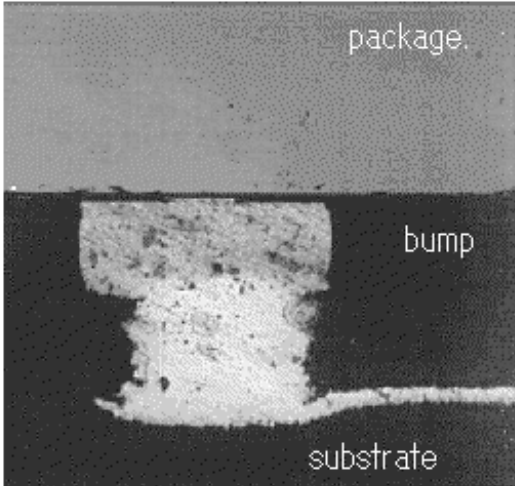

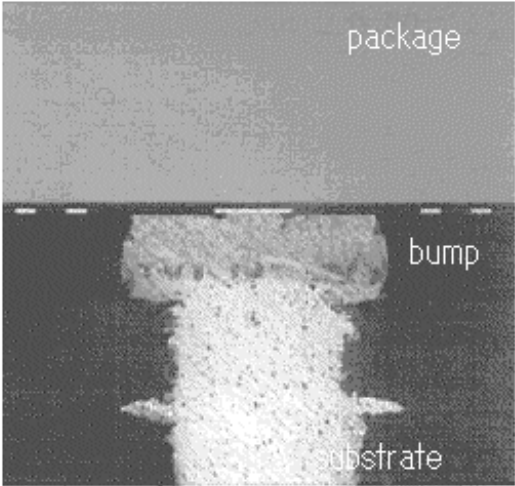



## Transition of bump height at 150deg.-C

solder : 64Sn/36Pb

stopper less	stopper	
150deg.-C for 1h	150deg.-C for 1h	150deg.-C for 8h
 <p data-bbox="254 1214 506 1263">  0.1mm</p>		

# Assembly Reliability

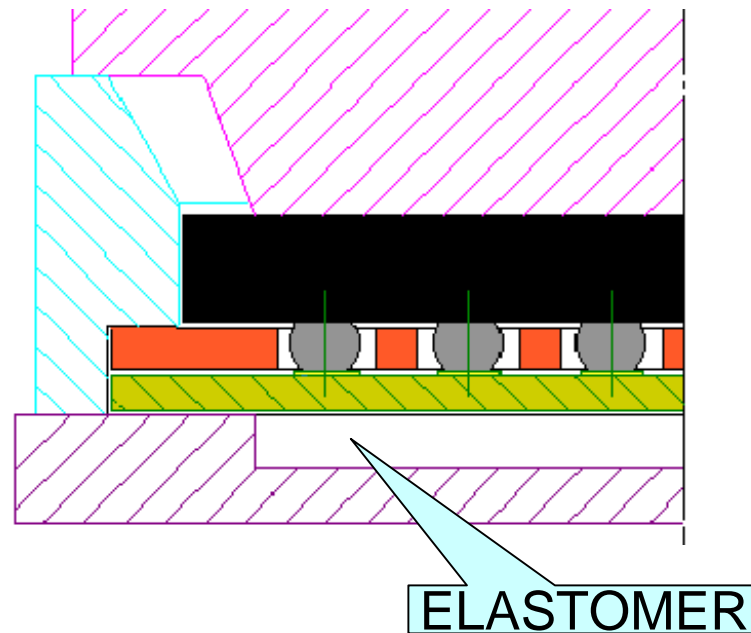
B/I less	150deg.-C for 2h
 <p>package.</p> <p>bump</p> <p>substrate</p> <p>90um</p> 	 <p>package</p> <p>bump</p> <p>substrate</p> <p>90um</p> 

**Cross section of mounted CSP256pin**

# Socket Technology

## Absorption for Uneven Solder Ball Height

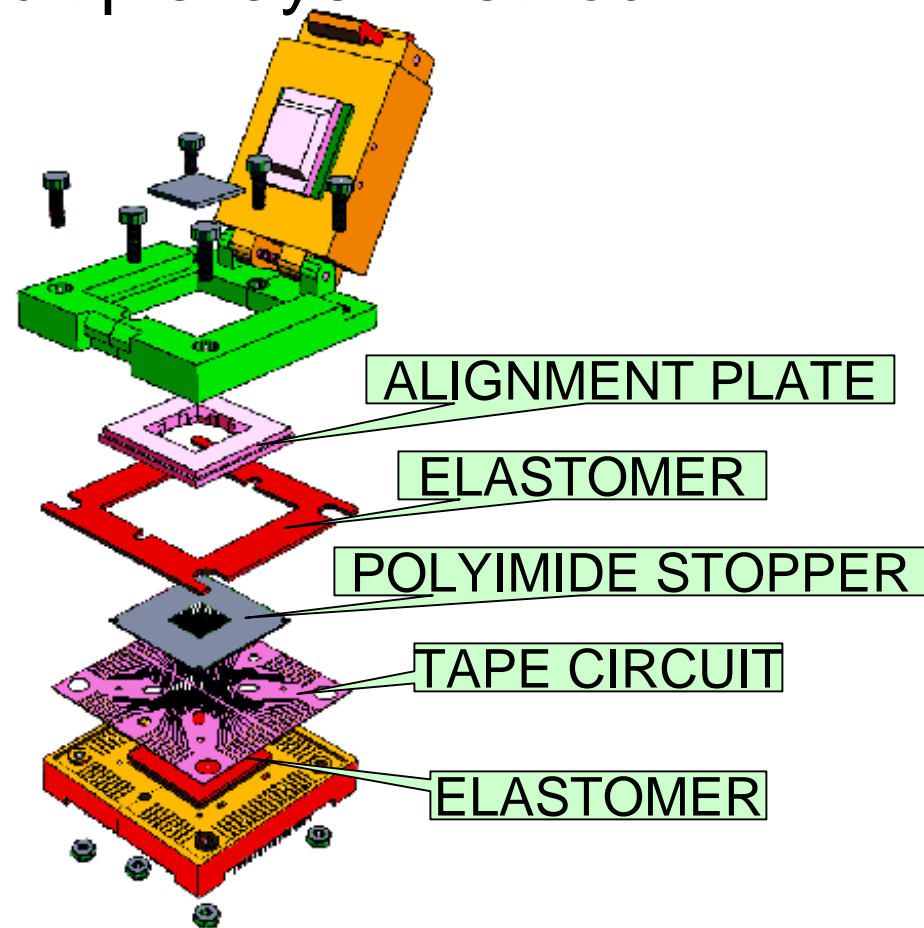
- Appropriate Contact Force
- Elastomer Application



# Socket Technology

## Accurate Alignment on Socket Assembly

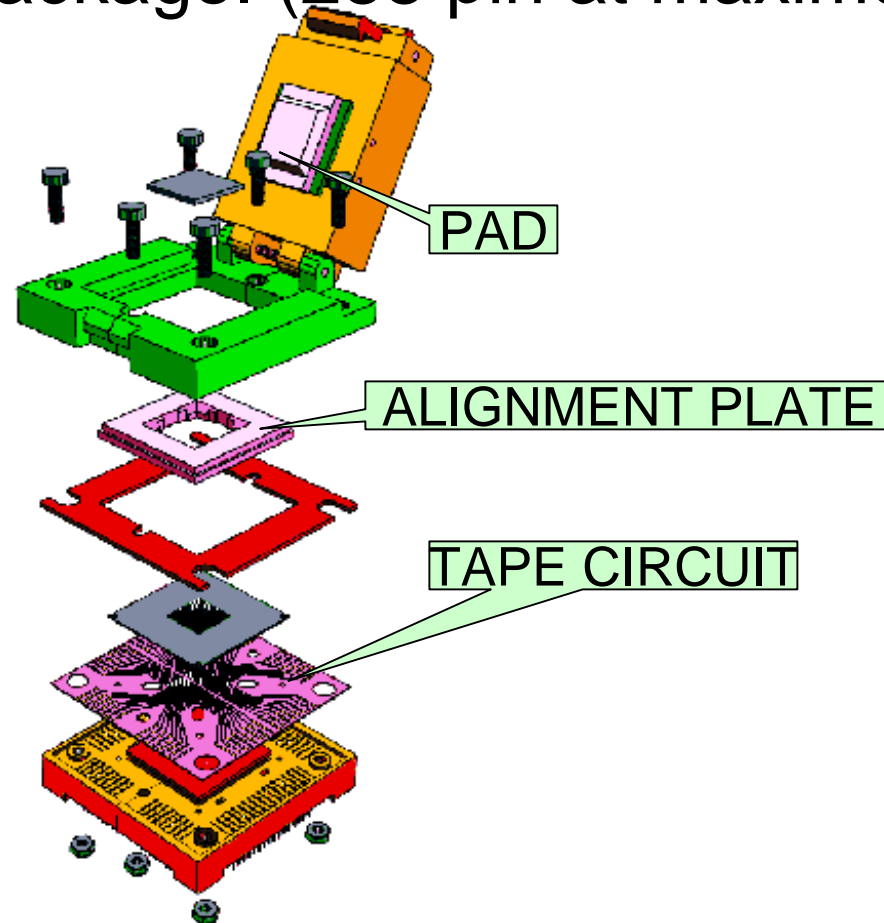
- Accurate alignment on socket assembly can realize by using multiple layer method.





# Socket Cost Reduction

- By increasing varieties of Tape circuit, alignment plate, and pad, this socket can widely apply with variety of BGA package. (288 pin at maximum)



# Socket Cost Reduction Series Lineup

- BGA-288-0.5 Series
- BGA-288-0.4 Series Plan
- BGA-420-0.5 Series Plan
- BGA-420-0.4 Series Plan
- BGA-676-0.5 Series Plan
- BGA-676-0.4 Series Plan

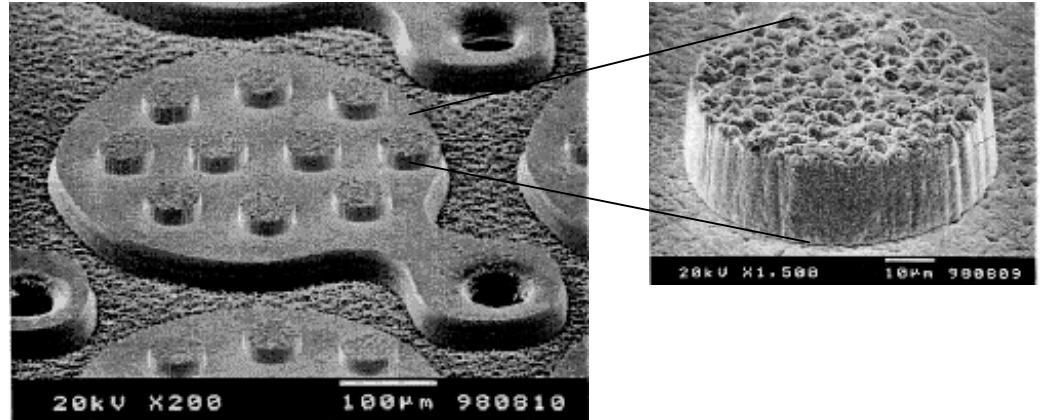
# Socket Cost Reduction BGA-288-0.5 Series Lineup

PKG Size	Grid		Full	5row	4row	3row	2row
6	11	11	121	120	112	96	72
7	12	12	144	140	128	108	80
7	13	13	169	160	144	120	88
8	14	14	196	180	160	132	96
8	15	15	225	200	176	144	104
9	16	16	256	220	192	156	112
9	17	17	289	240	208	168	120
10	18	18	324	260	224	180	128
10	19	19	361	280	240	192	136
11	20	20	400	300	256	204	144
11	21	21	441	320	272	216	152
12	22	22	484	340	288	228	160
12	23	23	529	360	304	240	168
13	24	24	576	380	320	252	176
13	25	25	625	400	336	264	184
14	26	26	676	420	352	276	192
14	27	27	729	440	368	288	200
15	28	28	784	460	384	300	208
15	29	29	841	480	400	312	216
16	30	30	900	500	416	324	224
16	31	31	961	520	432	336	232
17	32	32	1024	540	448	348	240
17	33	33	1089	560	464	360	248
18	34	34	1156	580	480	372	256
18	35	35	1225	600	496	384	264
19	36	36	1296	620	512	396	272
19	37	37	1369	640	528	408	280
20	38	38	1444	660	544	420	288

02/29/2000

# Future Development

- Applicable with LGA Package.



- Applicable with Future Market Demands of High Pin Count & Fine Pitch (0.3 & 0.4 mm pitch).
- More Cost Reduction by Realizing Multiple package / Tape Circuit per Socket
- Application for Test Socket

# Conclusion

- Development of Highly Reliable Contact
  - To Realize Longer Life of Contact
  - To Minimize Solder Ball Deformation
  - To Absorb Uneven Height of Solder Ball
  - To Improve Accurate Alignment on Socket Assembly by Applying Multiple Layered Socket
- Applicable with Current BIB Technology
- Socket Cost Reduction(Increasing Varieties of Tape Circuit, Alignment Plate, & Pad)
- Applicable with LGA & Future Market Demands(High Pin Count & Fine Pitch)