



# SWTEST

PROBE TODAY, FOR TOMORROW

**2022 CONFERENCE**

## 3D IC Probe Card Solutions



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June 5 - 8, 2022

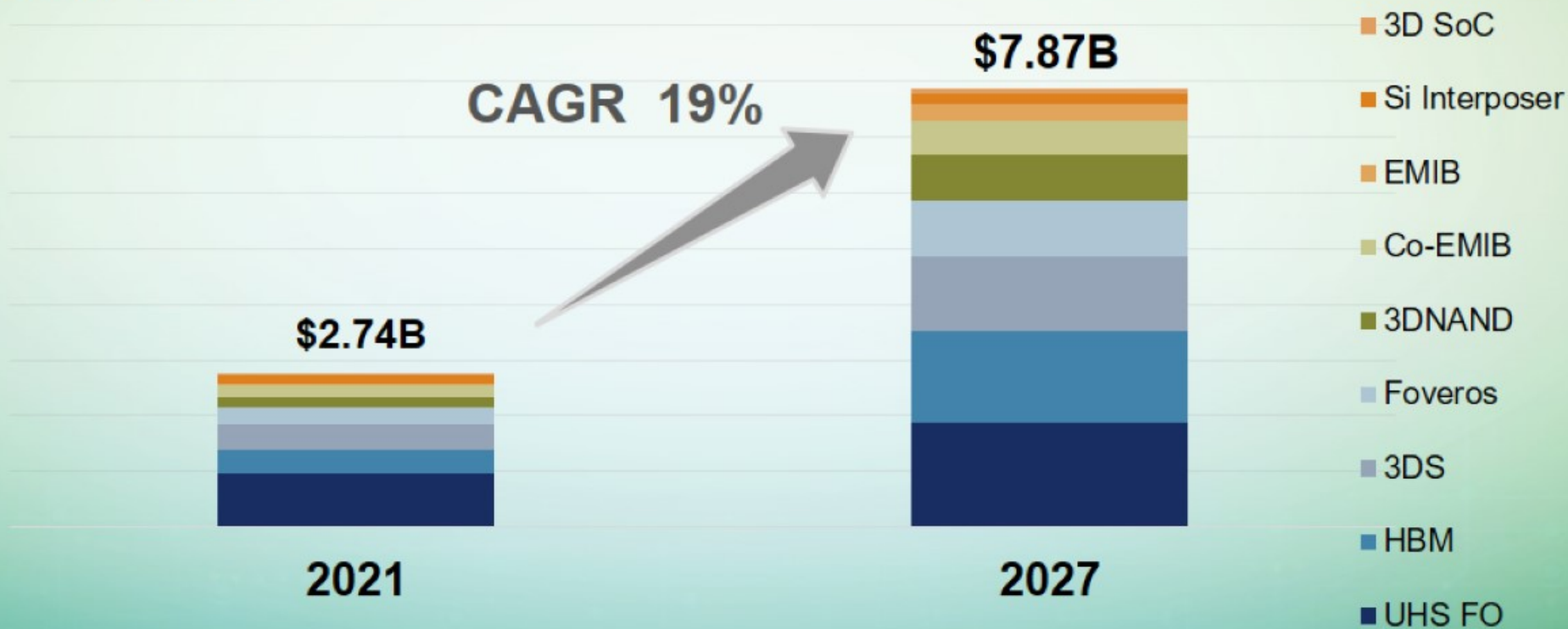
# Outline

- Trends and Challenges of IC Packaging & Testing
- Heterogeneous Integration Probe Card (HIPC) for 3D IC Test
- CHPT's HIPC Solutions
- Summary
- Follow-On Work

# Trends and Challenges of IC Packaging & Testing

- 2021-2027 High-End Packaging Market

The high-end packaging market size is expected to reach \$7.87B by 2027, rising at a market growth of 18.6% CAGR.



Source: Yole (2022) 、CHPT

Author : Alan Su

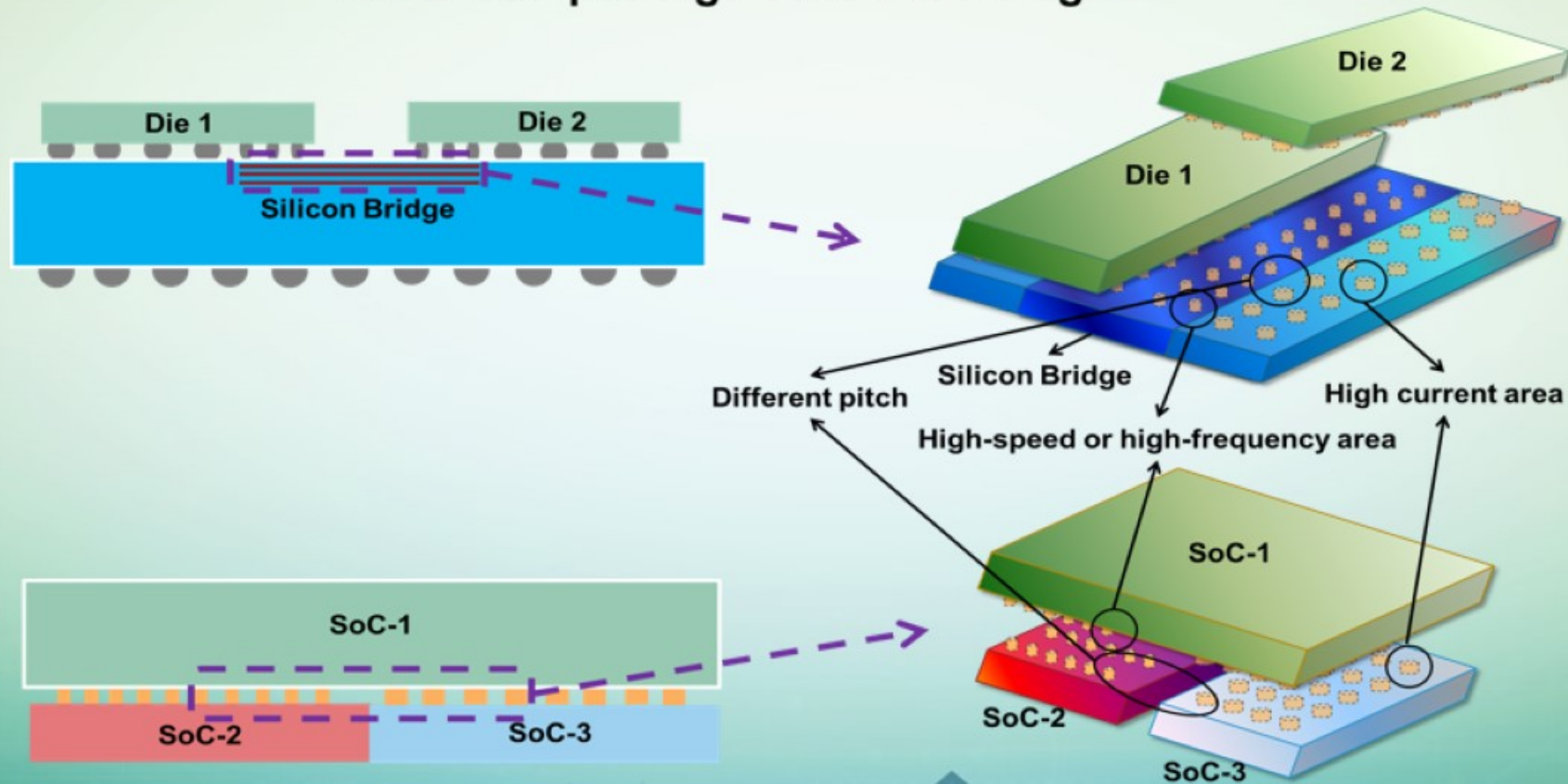
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# Trends and Challenges of IC Packaging & Testing

- Advanced Package Form & Testing Challenges

Advanced package schematic diagram



# HIPC for 3D IC Test

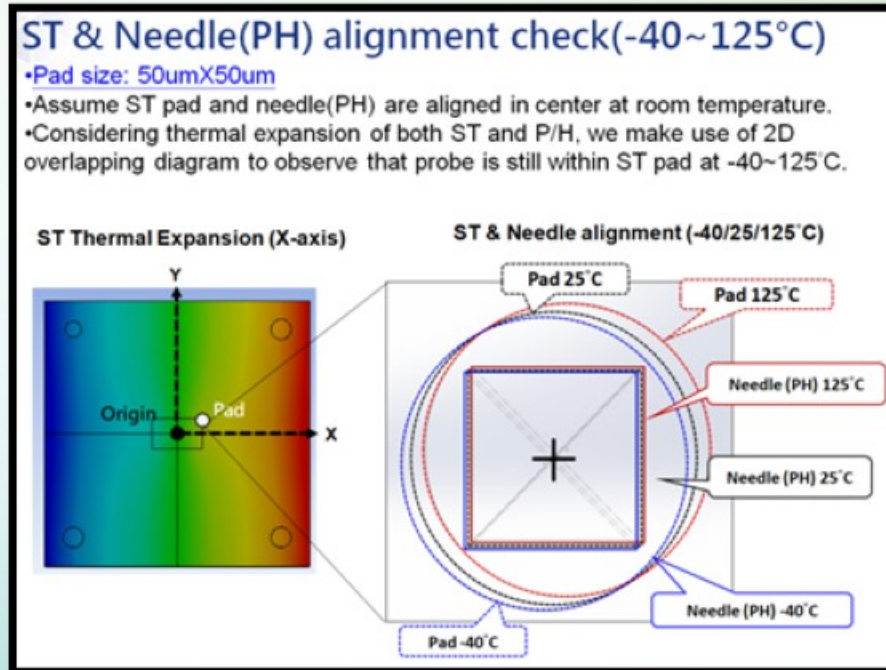
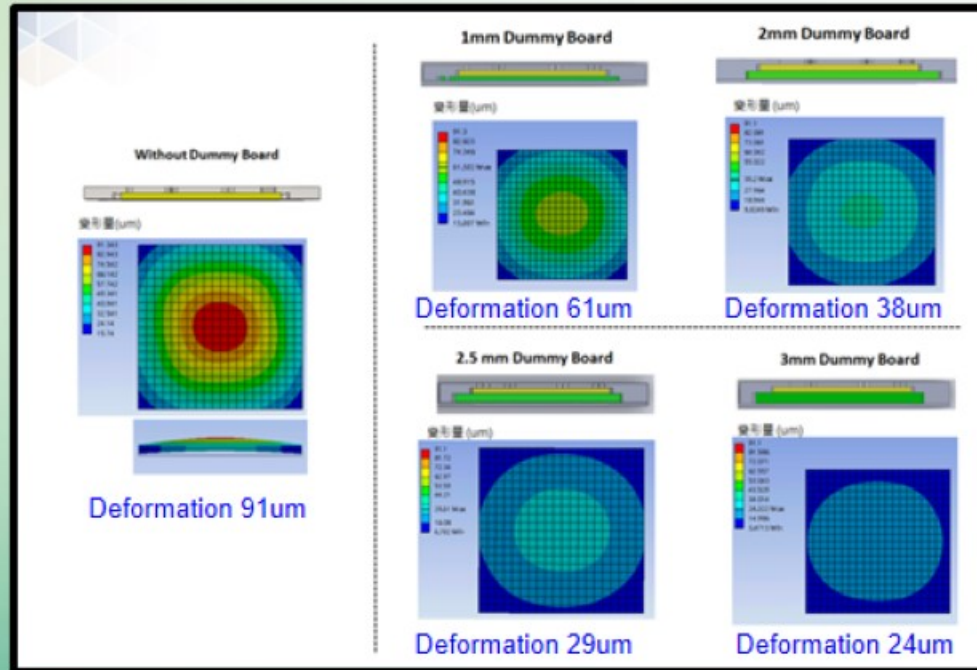
- **CHPT HIPC Provides High Speed Testing Solutions for Wafer Sorting**
  - **Structural Optimization:** How to reinforce probe needle, probe needle profile and guide plate through mechanical simulation?
  - **Contact Force Control:** How to optimize probe pin's characteristics? 2 different diameter probe needles offer the same contact force to meet probe mark spec.
  - **Bandwidth Improvement:** Bandwidth is the fundamental factor for successful high speed testing. How do we achieve desired bandwidth based on different bump/pad pattern?



# HIPC Solutions: Mechanical Optimization

- **Features of HIPC** : High Pin Count, High Temperature, High Current

Based on high temperature and high current test environment simulation to achieve optimized design of the probe card mechanism





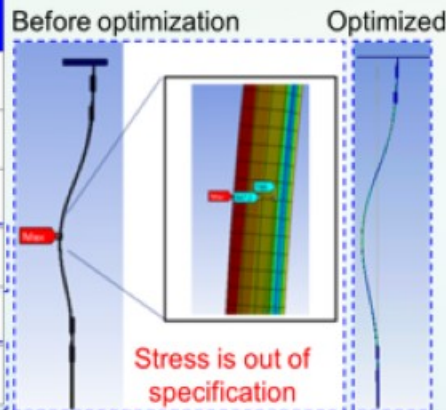
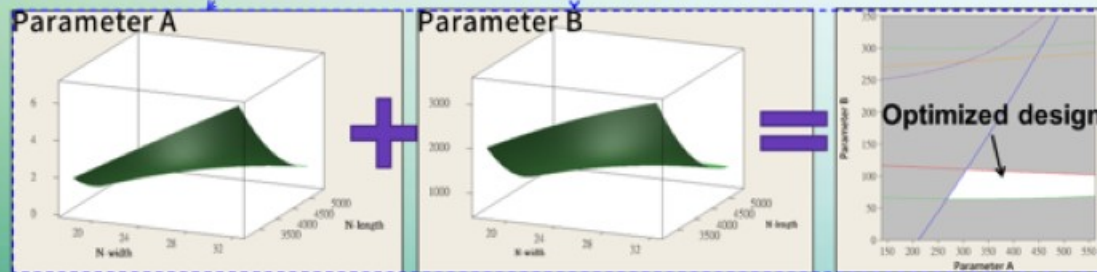
# HIPC Solutions: Structural Optimization

- **Customized Probe Card by AI, Smart Manufacturing**

The materials used in the guide plate and the probe are optimized by our algorithm

## Needle Material Selection and Design

Type	NS, SR, BR or BK series
Size	Optimized Needle Diameter
Minimum Pitch ( $\mu\text{m}$ )	Defined by Probe Position
Contact Force @ 100 $\mu\text{m}$ O.D (g)	Customized Definition
Needle Mechanical Properties	Material Selected by AI
Maximum Probing Current (A)	Maximum C.C.C.
Needle Shape Design	Set Parameters by AI



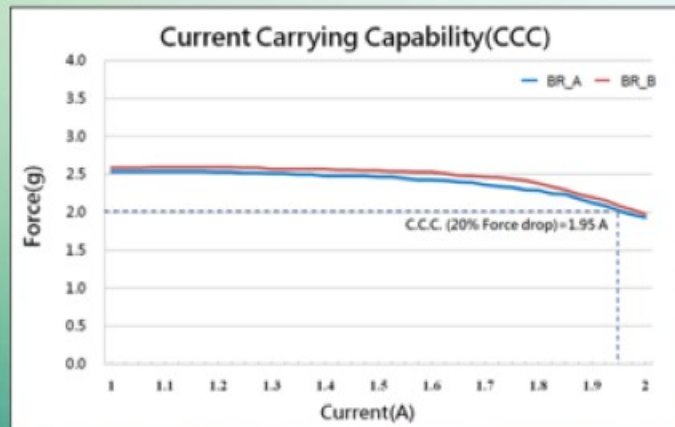
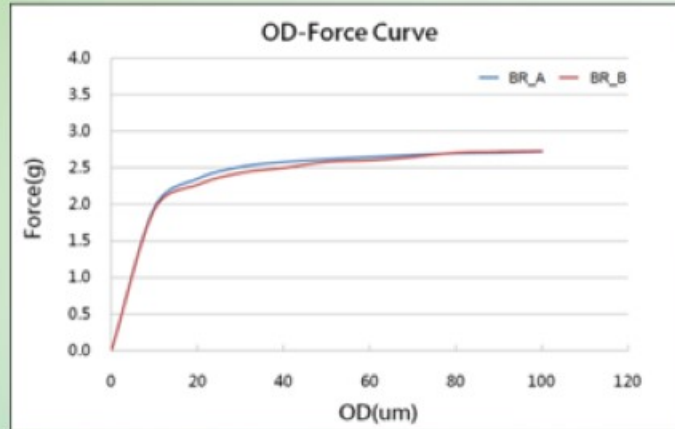
## Guide Plate Simulation and Design

Status	Before optimization	Optimized
Pattern		
Pin-count (pin)	~20,000	
Maximum Deformation ( $\mu\text{m}$ )	~95	<10
Note	CHPT implemented simulation results and material selection rules in the guide plate design. Using this method, the structural strength of the guide plate is enhanced and deformation is minimized.	

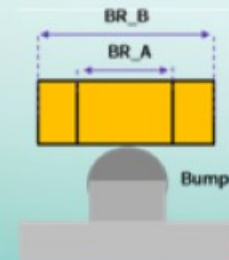
\* CHPT's HIPC technology has been patented or patent pending.

# HIPC Solutions: Contact Force Control

- Mixed Needle Design with Optimized Configuration: Contact Force Control



	60um		80um		100um	
TD/Temp.	25℃		25℃		25℃	
1 Time	PM size 11X15um	PM size 13X13um	PM size 12X18um	PM size 15X15um	PM size 12X18um	PM size 16X16um
2 Times	PM size 11X16um	PM size 15X15um	PM size 13X18um	PM size 16X16um	PM size 13X20um	PM size 17X17um
4 Times	PM size 11X16um	PM size 16X16um	PM size 13X19um	PM size 16X16um	PM size 15X20um	PM size 19X19um

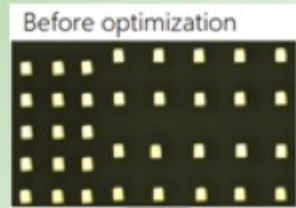


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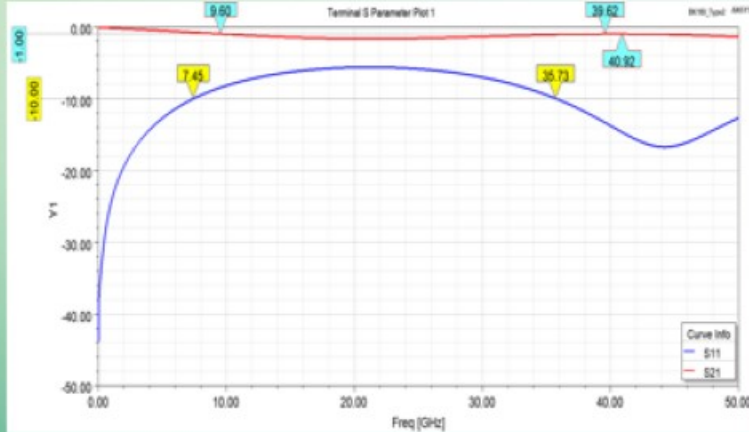


# HIPC Solutions: Bandwidth Improvement

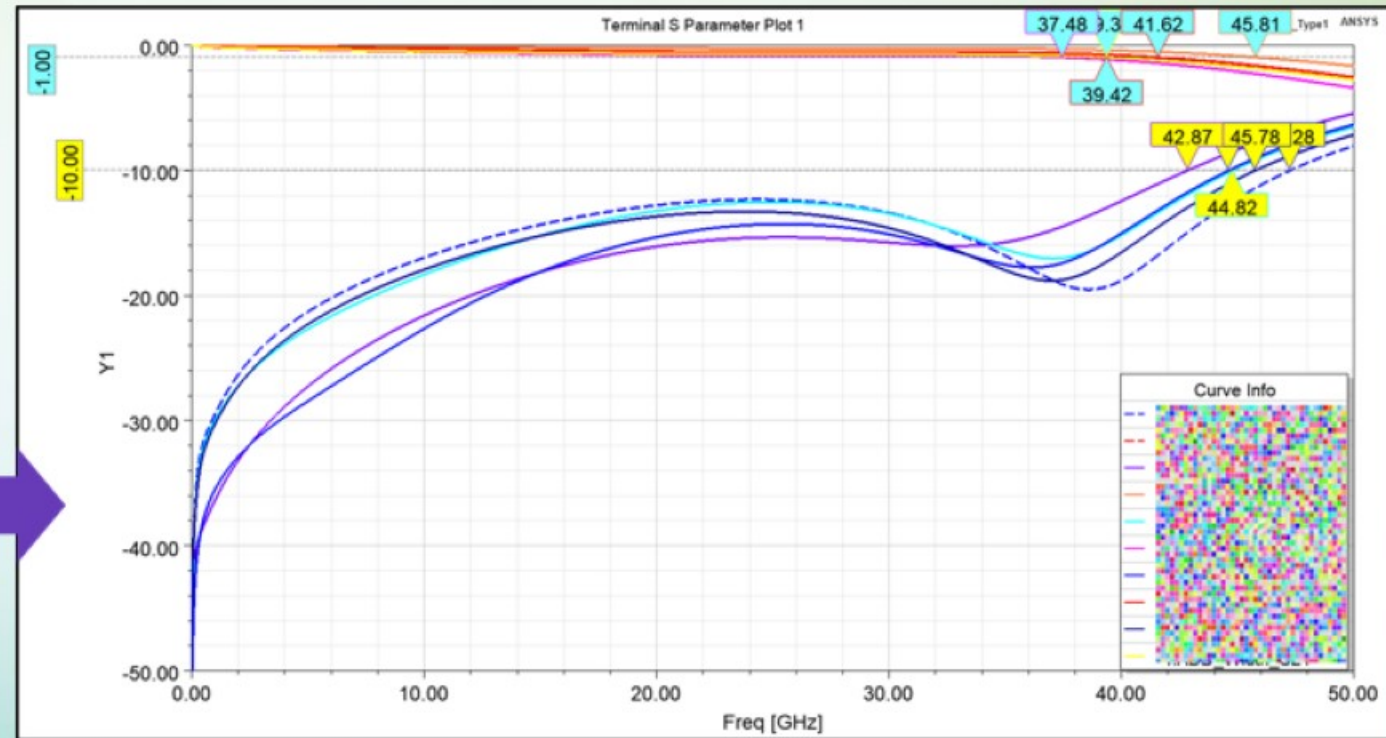
- Mixed Needle Design with Optimized Configuration: Bandwidth



Before optimization



Optimized



# HIPC Solutions: Mixed Needle

- CHPT's HIPC Solutions Can Work Stably in Bandwidth Testing Projects

Specification	BR Series	NS Series
Applicable Pitch (um)	110~180	50~100
Contact Force (@ 4mils O.D.)(g)	2.0~4.3	1.5~4.0
Current Carrying Capability (mA) (ISMI 2009)	1,800~2,400	500~1,200
Temperature (°C)	-40~150	-40~150

Standard Type		High Frequency/Current
NS80	Mixed {	BR120 BR130 BR150 BR160

High Frequency/Current		High Frequency/Current
BR120 BR130 BR150 BR160 BR180	Mixed {	BR120 BR130 BR150 BR160 BR180



# HIPC Solutions: Case Study

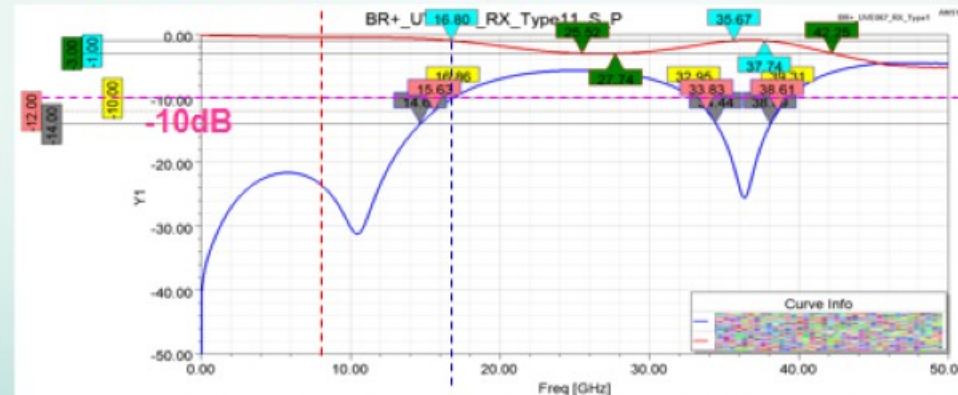
- Mixed Needle Design Practical Case Sharing

## Needle Arrangement



## Spec. Requirements vs. Electrical Simulation Results

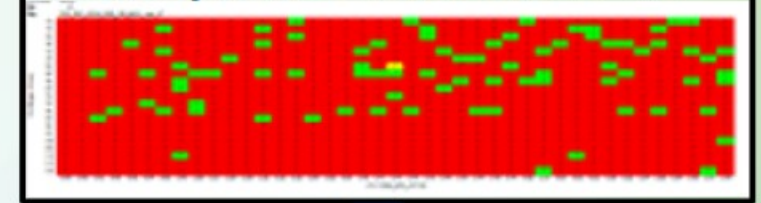
Test Specifications: 8GHz@-10dB



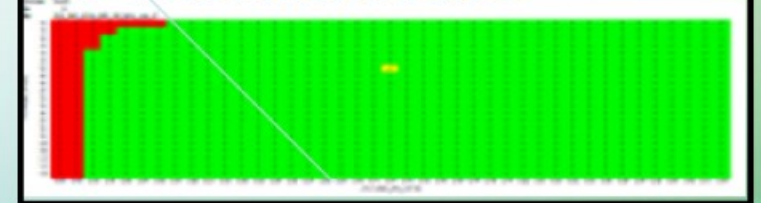
Simulation results: 16.8GHz@-10dB

## Electrical Diagram : Shmoo

### Non-Optimized Needle : Fail



### HIPC Solution : Pass

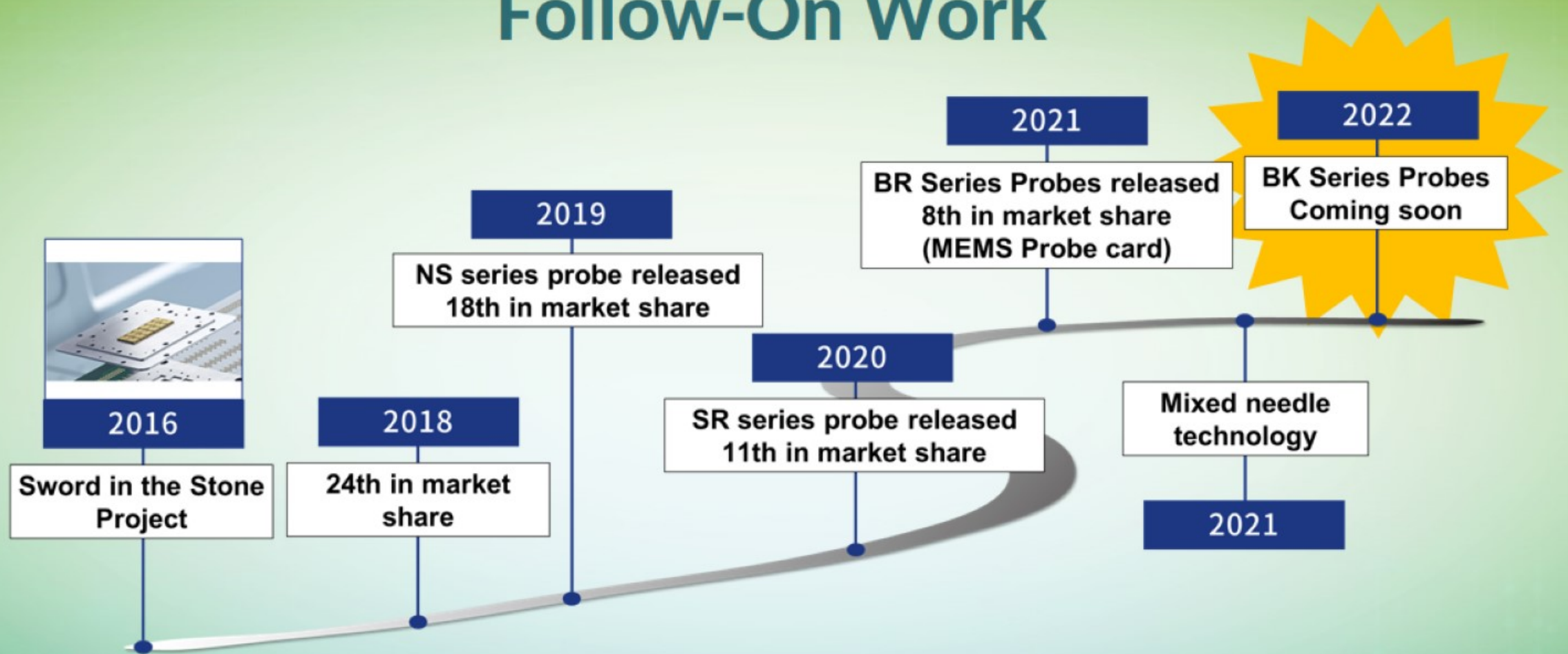


# Summary

- **Semiconductor 3D IC market growth at 18.6% CAGR.**
- **Advanced packaging technology highlights the importance of HIPC.**
- **Our product from PCB, interposer to probe head are AI optimized with smart manufacturing.**
- **CHPT's high-quality HIPC solution meets the requirements of high pin count, high current and optimized bandwidth at the different pitches.**



# Follow-On Work



BK series needles have better CCC and excellent bandwidth characteristics. The single-pin CCC can reach 2.5A and the bandwidth can reach more than 28GHz under proper arrangement.