

## Through Silicon Via (TSV)

### Through Silicon Via (TSV) Wafer Finishing & Flip Chip Stacking

Through Silicon Via (TSV) interconnects have emerged to serve a wide range of 2.5D-TSV & 3D-TSV packaging applications and architectures that demand very high performance and functionality at the lowest energy/performance metric. To enable the use of TSVs in these 2.5D/3D-TSV architectures, Amkor has developed a number of back-end technology platforms to enable high volume processing of TSV-bearing wafers and assembly. It is important to distinguish that Amkor does not provide TSV formation in foundry wafers. Amkor's TSV wafer process begins with 300 mm wafers which have TSVs already formed. Amkor's wafer process thins the wafers and creates back side (BS) metallization to complete the TSV interconnection. The TSV reveal and backside (BS) metallization process flow is commonly referred to as "Middle-End-Of-Line" (MEOL). Amkor's MEOL production tooling and processes include:

- Wafer support bonding and de-bonding
- TSV wafer thinning
- TSV reveal and CMP
- Back side passivation
- Redistribution as required
- Lead-free plating of micro-pillar and C4 interconnects
- Wafer-level probe and mid-assembly test for TSV products

### Amkor's Role in 2.5D-TSV & 3D-TSV Packaging with TSV Interconnects

Amkor has enabled TSV technology solutions for the back-end processing of TSV wafers (MEOL), bumping and 2.5D-TSV & 3D-TSV assemblies. This requires advanced capability in the following key areas:

- Wafer support bond and de-bond of TSV bearing wafers
  - Wafer Support System (WSS) for thin wafer management
- TSV MEOL processing
  - Wafer support system (WSS) for thin wafer management
  - Bonding and de-bonding of TSV bearing wafers
  - Wafer thinning to 50µm (3D-TSV) or 100µm (2.5D-TSV) per product requirements
  - Wafer backside passivation
  - TSV reveal process including CMP planarization
- Advanced TSV wafer finishing:
  - Front side and back side wafer bumping
  - 40 µm pitch Cu pillar and landing pad micro-bumps
  - Backside redistribution
- Advanced assembly technology:
  - Flip chip stacking of thin TSV micro-bumped die
  - Chip-to-Substrate flip chip attach (CoS)
  - Chip-to-Wafer flip chip attach (CoW)
  - 25-60 mm FCBGA body sizes for 2.5D-TSV assembly integration
  - 10-25 mm FCCSP body sizes for 3D-TSV assembly integration
  - Bare die, lidded, and overmold final assembly options available
  - Intermediate electrical test for partially assembled CoS & CoW modules
- Qualifications
  - 3D-TSV platforms
  - 2.5D-TSV platforms

### 2.5D Platform (Examples of products produced to date are shown here to demonstrate Amkor's production capabilities)

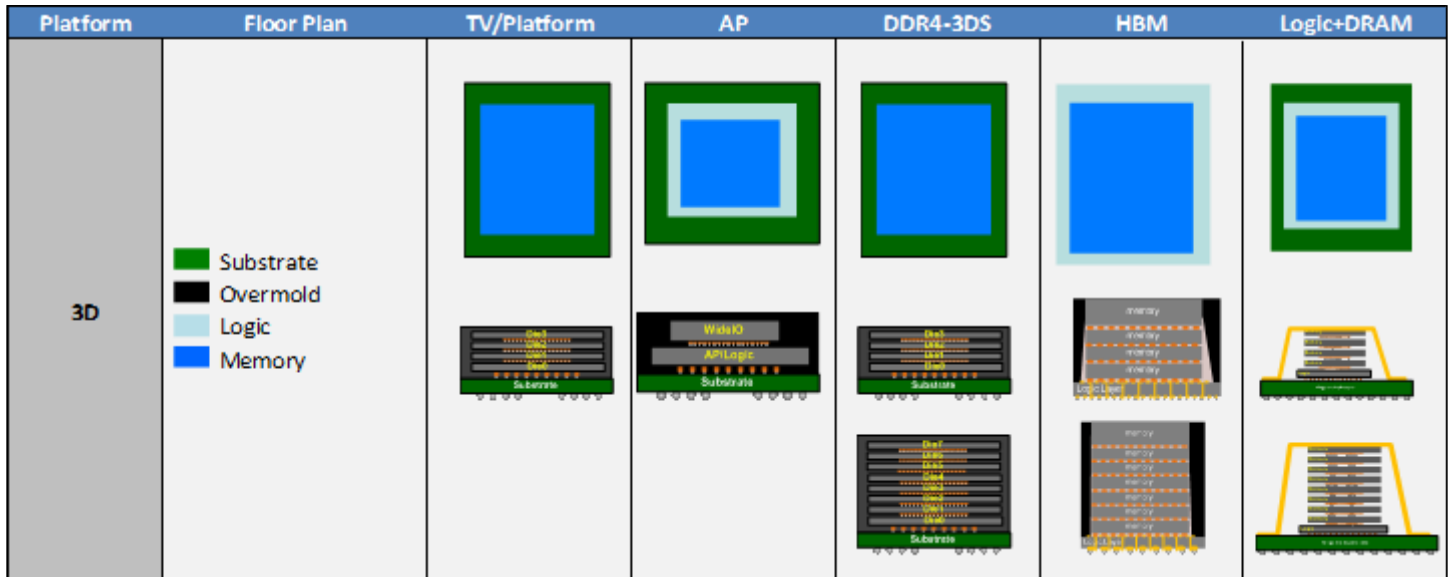
Platform	Floor Plan	TV/Platform	GPU	Networking	FPGA	Server
2.5D	<ul style="list-style-type: none"> <li>Substrate</li> <li>Si Interposer</li> <li>Organic Interposer</li> <li>Logic</li> <li>Memory/Small logic</li> </ul>					

Visit Amkor Technology online for locations and to view the most current product information.

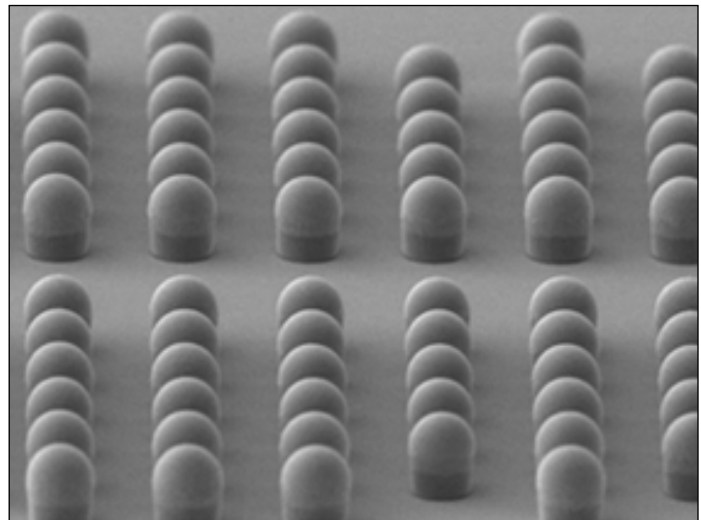
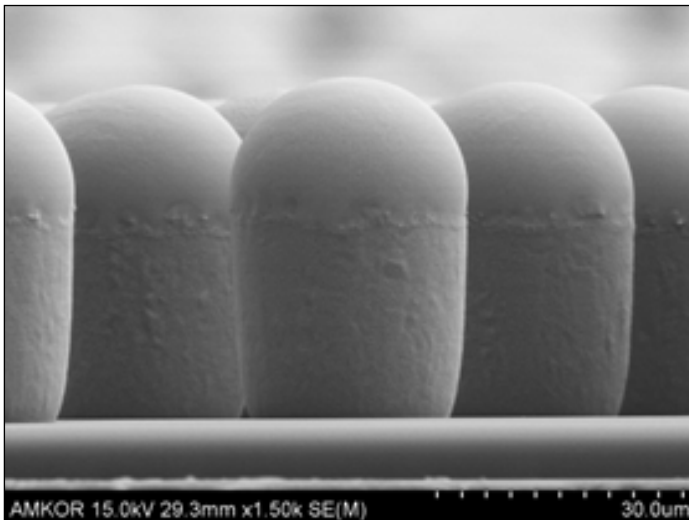


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3D Platform (Examples of products produced to date are shown here to demonstrate Amkor's production capabilities)



## Fine Pitch Copper Pillar Bumping – The Backbone of TSV Assemblies and Advanced Packaging

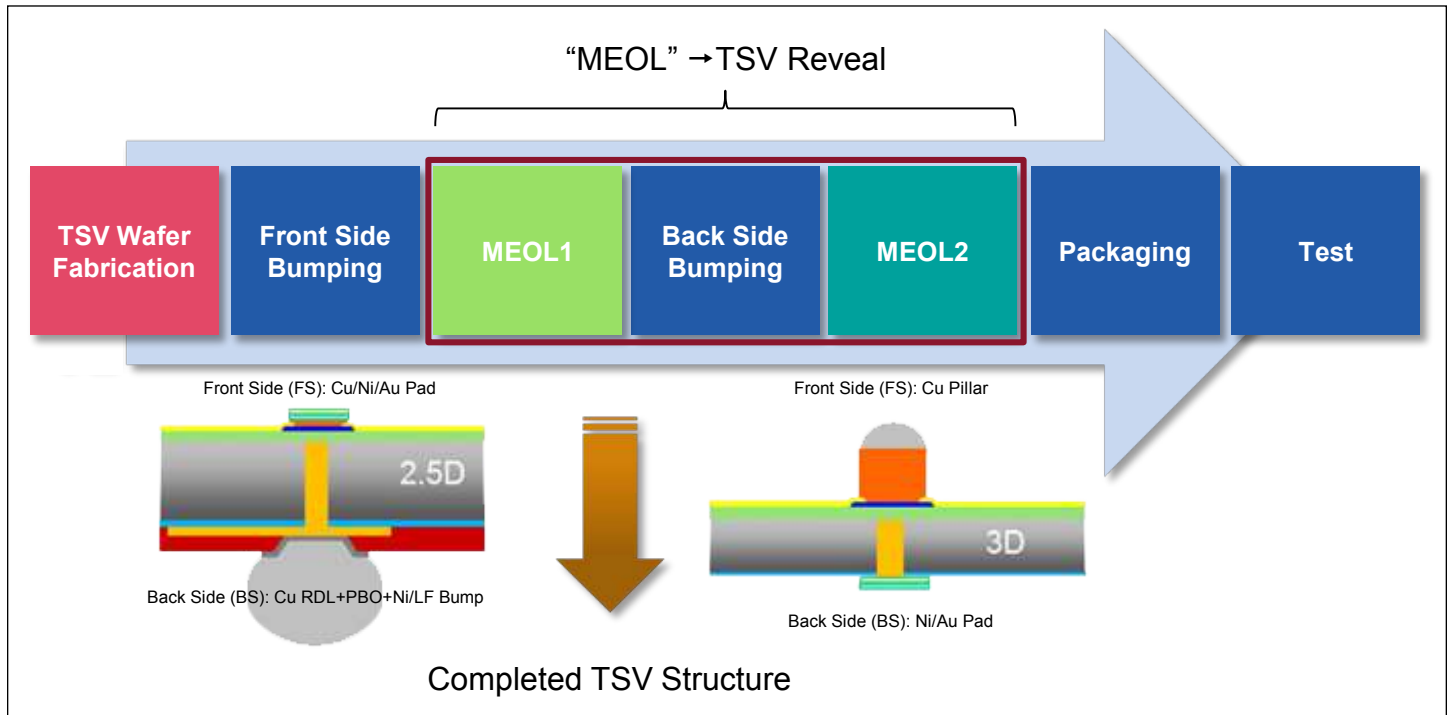


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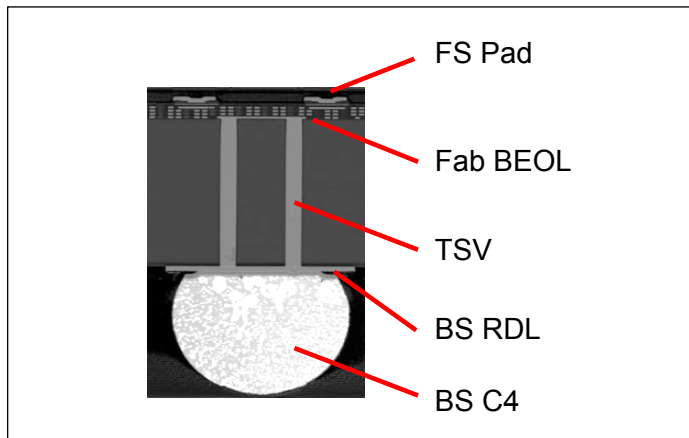


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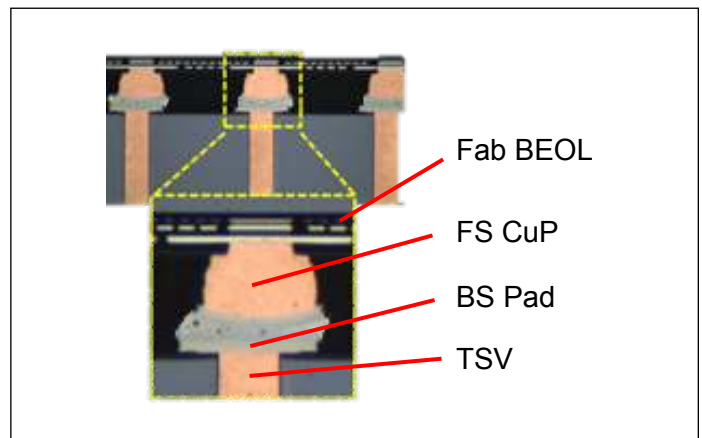
## 2.5D & 3D TSV Reveal Processing (MEOL)



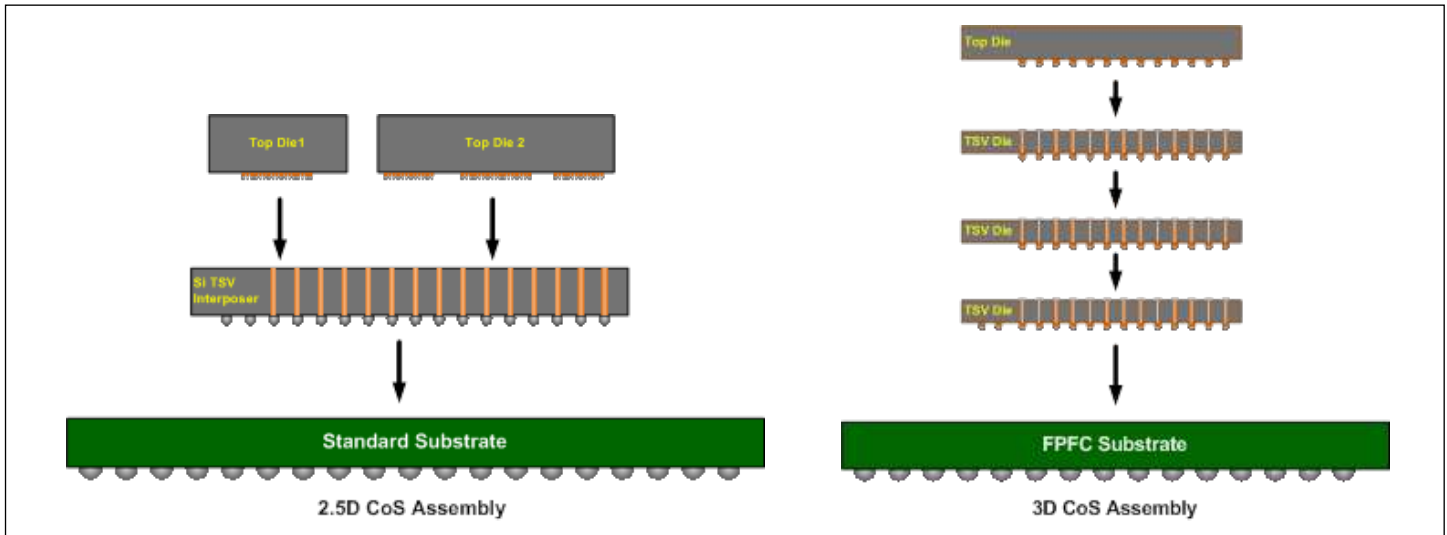
### 2.5D TSV Integration



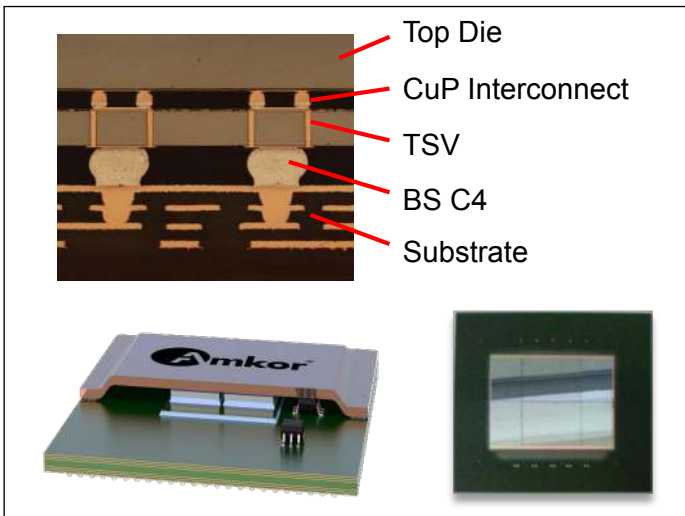
### 3D TSV Integration



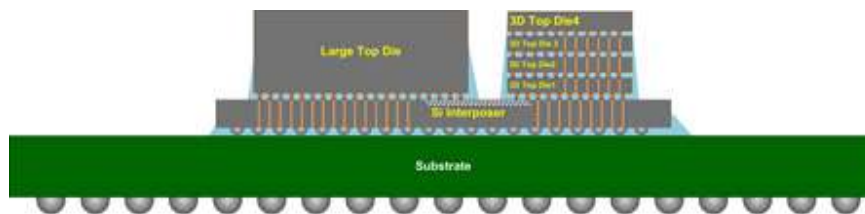
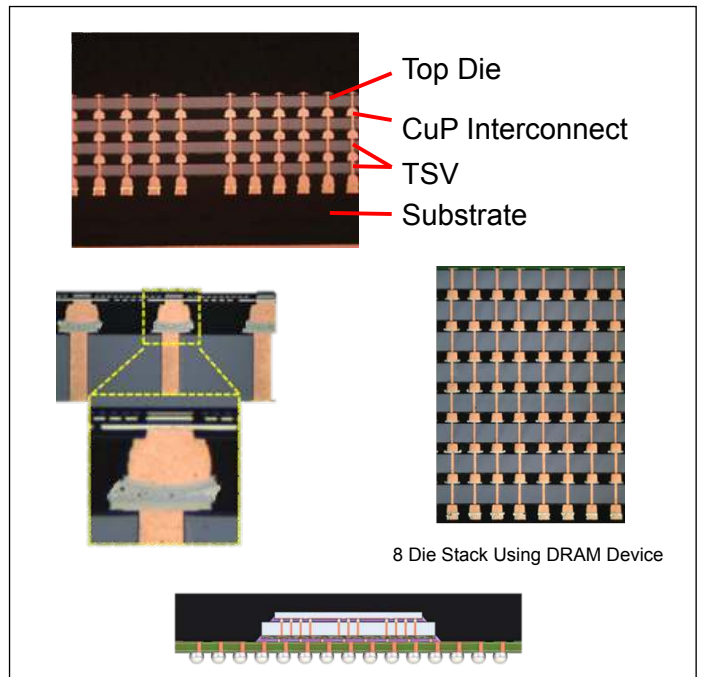
## Amkor TSV Assembly Platform CoS (Chip on Substrate) Assembly Die Stacking



### 2.5D CoS Final Assembly



### 3D CoS Final Assembly



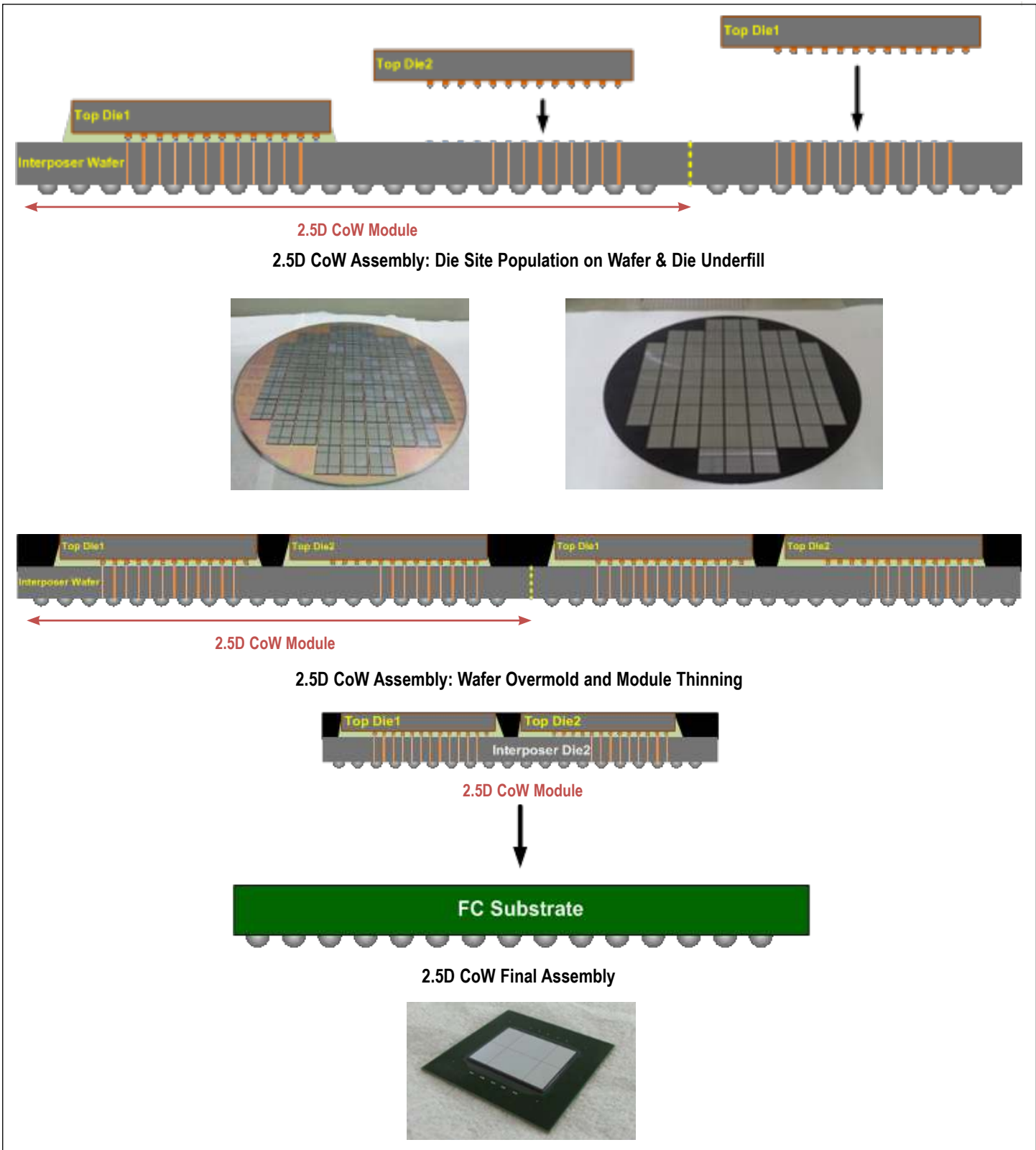
2.5D + 3D Assembly

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## CoW (Chip on Wafer) Assembly Die Stacking



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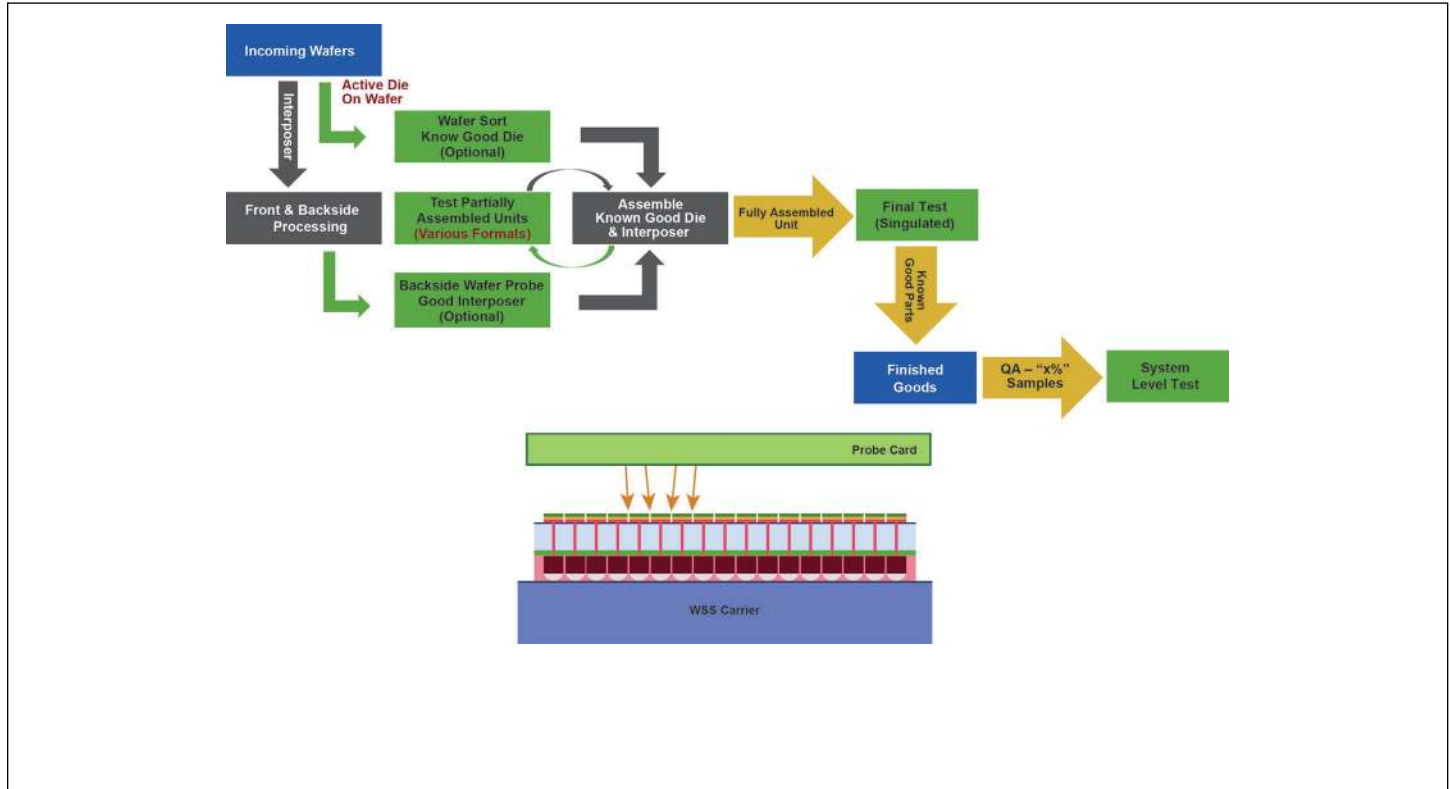


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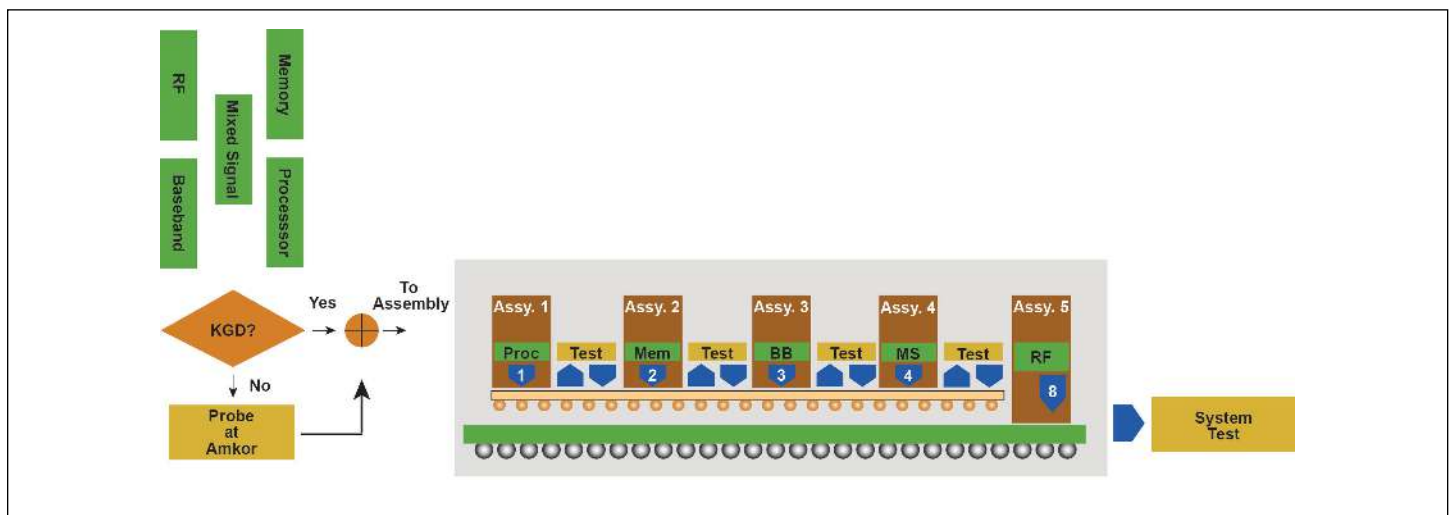
## Amkor TSV Test Platform

Amkor supports optional test wafer and package socketing at strategic, interim assembly phases.

### Wafer Probe During MEOL



### Wafer and Package Test at Assembly



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