

Electronic Interconnect Convergence

... through large panel fan-out



Tim Olson Founder & CTO



Remember when? ... there were 3 distinct industries

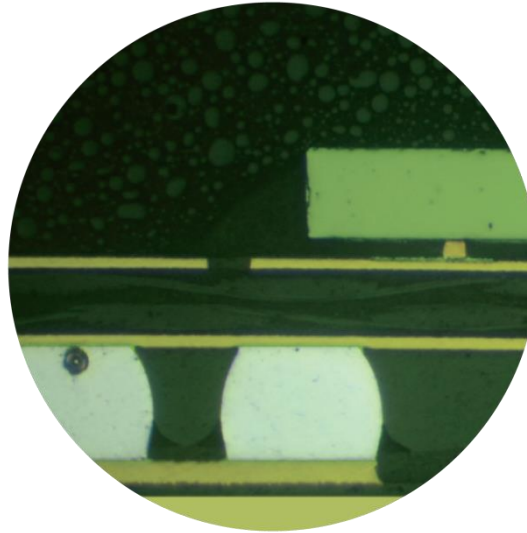
Wafer Foundries



Semiconductor Device

Nanometers

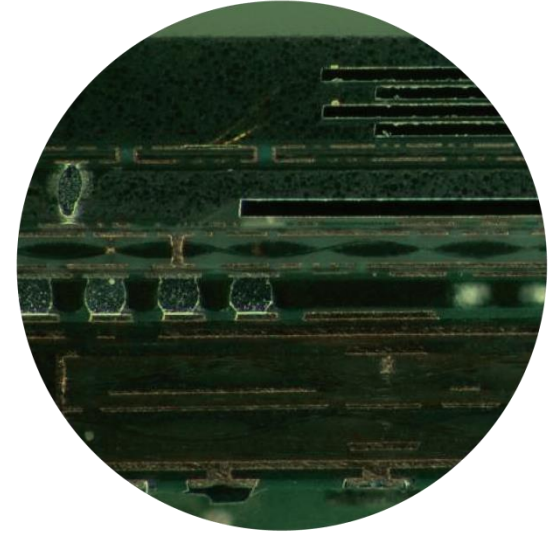
OSATs



Packaging

10's of Microns

EMS



Electronic Systems

100's of Microns

Remember when? ... there were 3 distinct industries

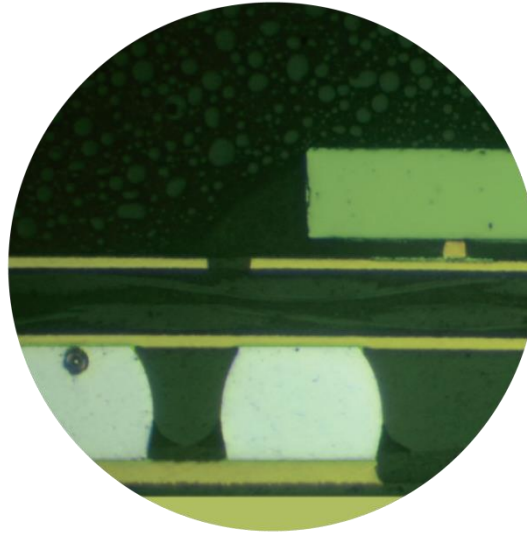
Wafer Foundries



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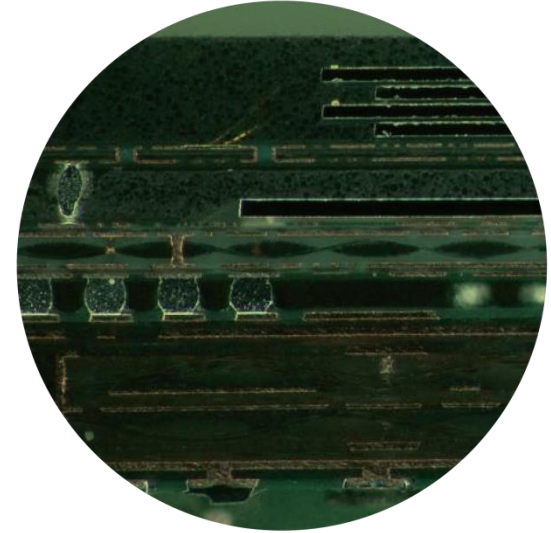
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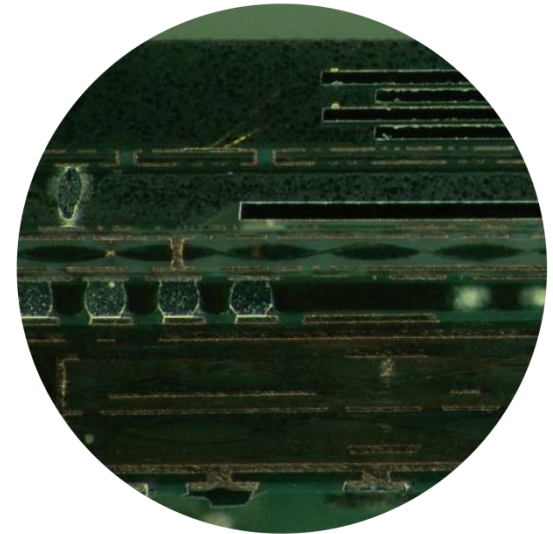
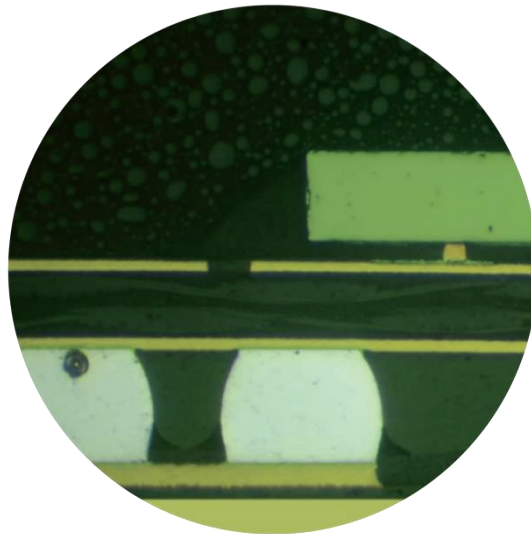
EMS



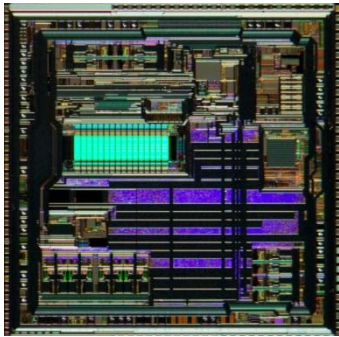
Electronic Systems

100's of Microns

Today, the lines are blurring

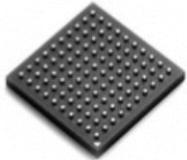


... while electronic interconnect cost remains quite different



Device Level Electronic Interconnect

<u>Technology</u>	<u>Typical Geometries</u>	<u>Typical Cost</u>
Digital processor	14 nm	6 ¢ per mm ²
Analog	40 to 150nm	3 ¢ per mm ²
RF	55 to 180nm	2 ¢ per mm ²



Packaging - 1st Level Elec. Interconnect

	<u>Typical Cost</u>
Flip chip CSP packaging	0.7 ¢ per mm ²

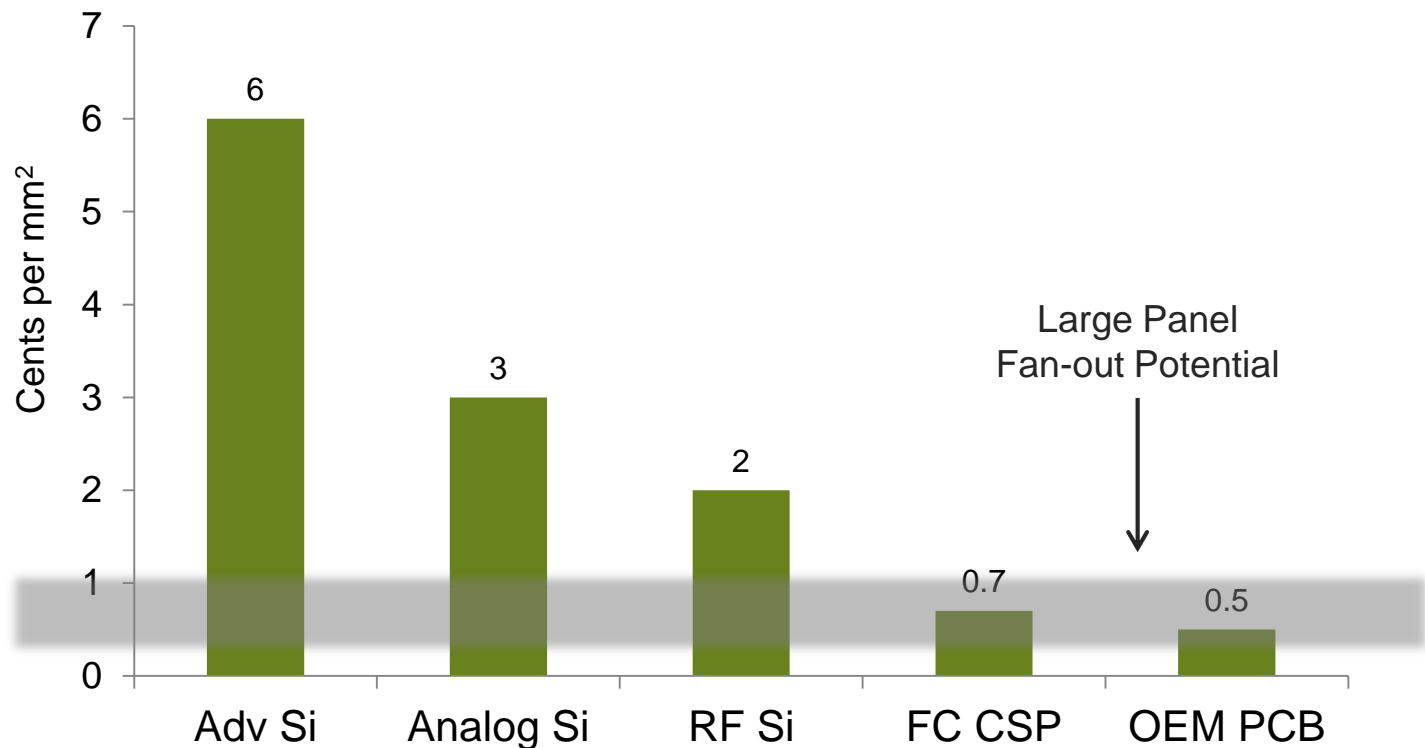


EMS - 2nd Level Elec. Interconnect

	<u>Typical Cost</u>
10 layer Smartphone motherboard	0.5 ¢ per mm ²

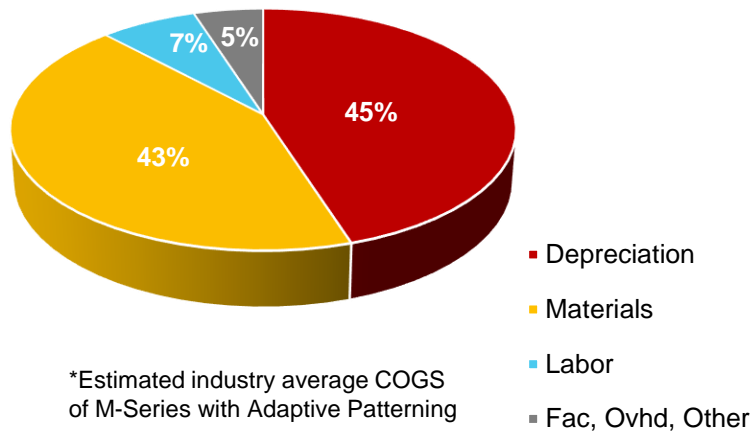
Where does large panel fan-out fit?

Technology Cost Comparison
(Sales price to customers)

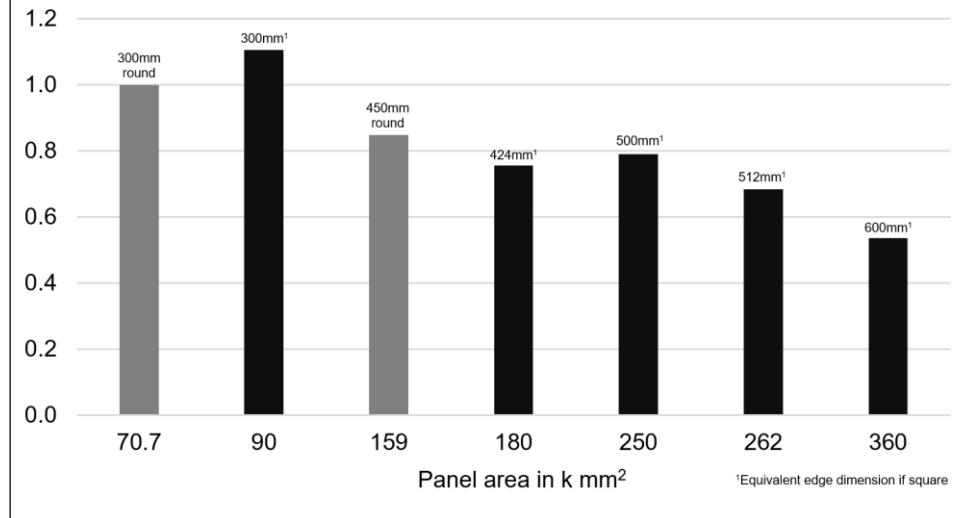


The basics of cost for capacity

**Wafer Processing Cost
300mm round baseline***



**Estimated capital to install 30k per month capacity
(300mm round panel equivalent)**



Large panel fan-out has the potential for >30% cost reduction

- Capital productivity
- Material efficiency

Breaking through the barriers

Wafer level
capital cost
breakthrough



SUNPOWER

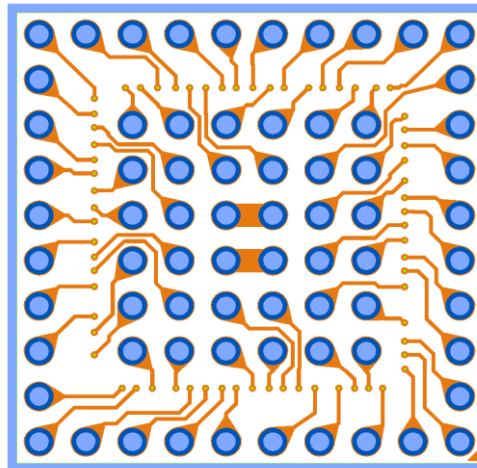
Solar wafer fab inspired approach

Chip attach
cost
breakthrough



Adaptive Alignment*

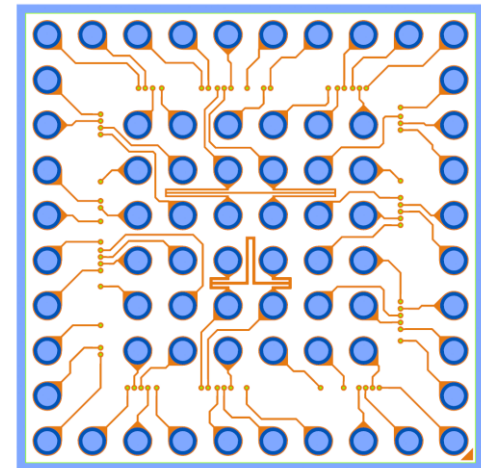
Align the entire RDL pattern
to the measured die position



Enables high metal density designs
Precisely aligns inductors to the die

Adaptive Routing*

Dynamically adapt RDL routing
to the measured die position



BGA array fixed to package outline
Enables multi-die fan-out

thru

*Adaptive
Patterning™*



*Note: Multiple patents issued & pending



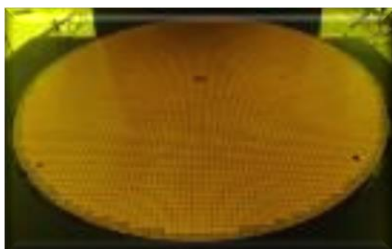
Deca Technologies

... the future is near

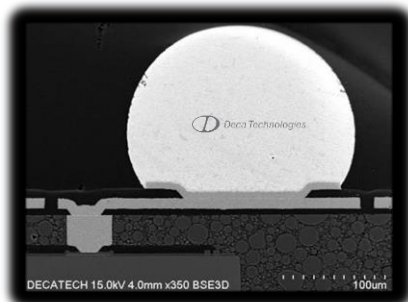
... in cooperation with ASE



Initial Production



300mm round



M-Series Structure*

Future Production



(post chip attach)



(post mold & debond)

Large panel format M-Series*

*Note: Multiple patents issued & pending



Thank You

