Amkor Technology®

Trends and Challenges in Semiconductor Advanced Packaging

John Stone I EVP and Chief Sales Officer

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Agenda

1	Amkor Introduction
2	Advanced Packaging Trends
3	Advanced Packaging Challenges

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Amkor Introduction

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Amkor by the Numbers

Founded in
1968

$4.1B
Net Sales*

30,000
Employees

$475M
CapEx*

11,000,000
Square Feet of
Manufacturing Space

Footprint in
11 countries

End Markets

Automotive

Communications

Industrial

Computing

Consumer

*2019 results

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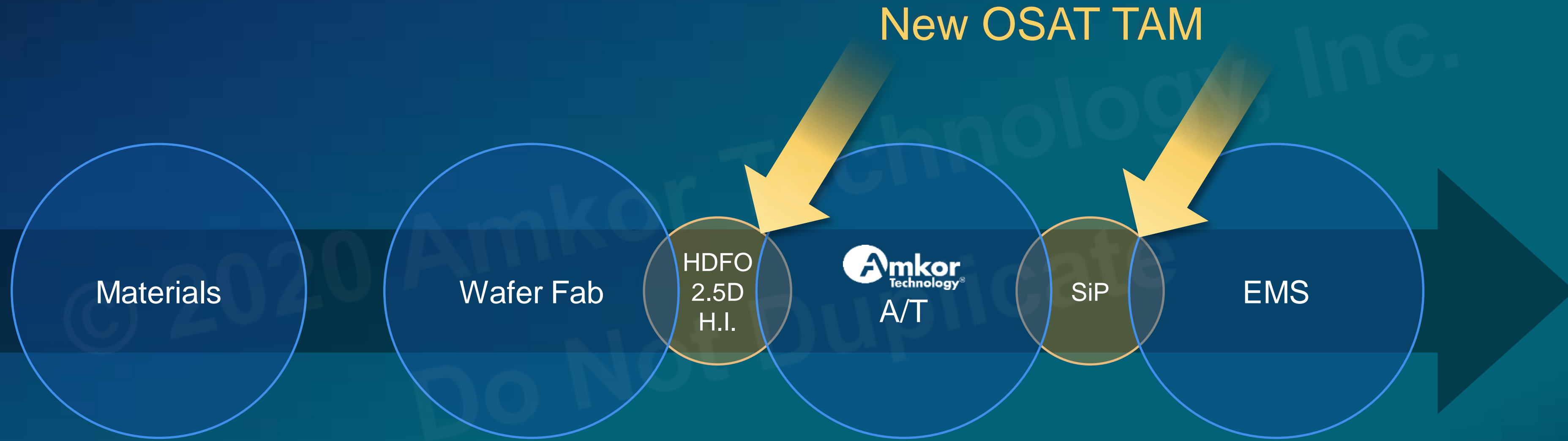
Amkor in the Supply Chain



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Broad Geographic Footprint

11 million square feet of manufacturing space

Global Principal Entity
Amkor Headquarters
Sales/Customer Support Center
Advanced
Mainstream

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Flagship Factory – Incheon Korea

- 2.3M ft^2 on 46 acres
- >6,000 employees
- R&D Center
- Advanced packaging
- Green building

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Advanced Packaging Trends

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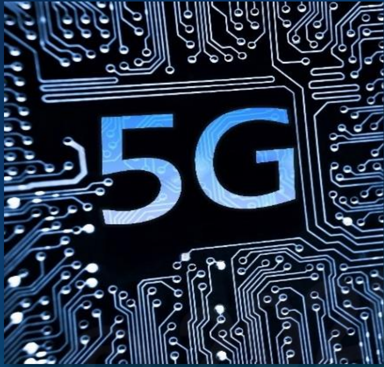
Key Growth Catalysts



5G

Mobile Communications
Connected Devices
Automotive
Speed, Streaming

Automotive

Autonomous Driving
Infotainment
Electrification
Safety

IoT

"Smart Everything"
Connected Home
Wearables
Industrial Automation

Networking

Data Center
Analytics
High Performance Computing
Artificial Intelligence

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Advanced Packaging in Your Smartphone

Requirements

- Smaller footprint, minimum height
- Wafer level packaging
- 3D structures
- Multi-die packages
- Signal integrity

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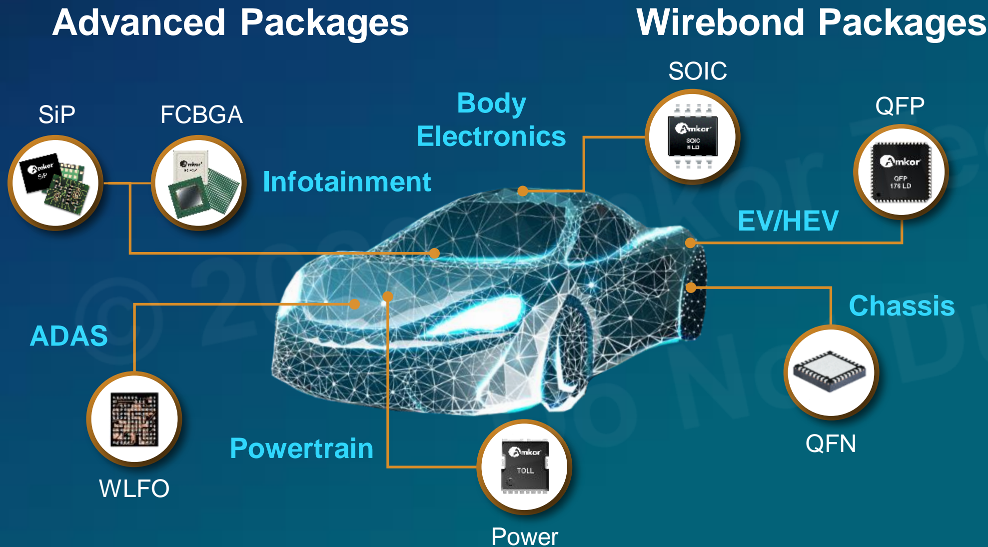
Enabling New Applications in the Car



Environment

- Zero defect mindset
- High reliability requirements
- Reduced time to market
- New package configurations
- Advanced packaging adoption

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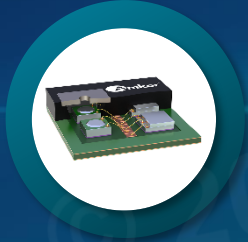
IoT Made Possible

Multiple Applications

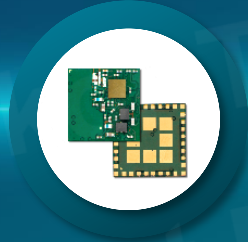


Connectivity
Sensing
Computing
Storage

Diverse Requirements

Power
Bandwidth
Integration
Security

Scale



Amkor ships billions of IoT devices per year!

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Big Data Requirements

Data Center

HPC, AI, ML
Thermal Management
FCBGA, HDFO, SiP

Networking

High-Speed Switch
Logic + Memory Integration
SiP, HDFO, 2,5D

Storage

Solid State Drive
Memory Die Stacking
Stack CSP, WBBGA, SiP

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Advanced Packaging Challenges

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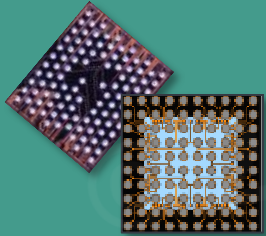
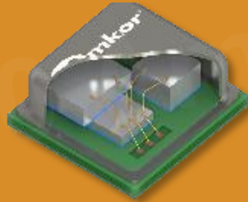
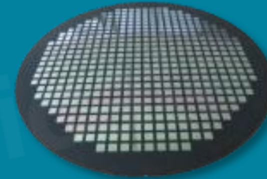
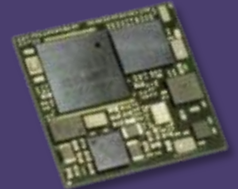
Advanced Packaging Platforms

Chip Scale to Fan-Out	MEMS	Flip Chip	Heterogeneous Integration	System in Package
				
Wafer	Laminate, LF & Wafer	Laminate	Laminate or Wafer	Laminate

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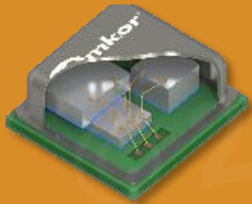
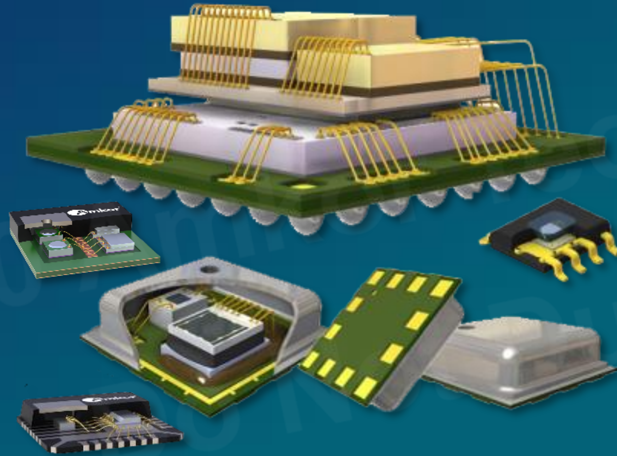
MEMS

MEMS



Laminate, LF & Wafer



- IoT, wearables & industrial
  - Sensor fusion
  - Low power, form factor & cost
  - System & functional integration
    - Many die, broad packaging toolkit required

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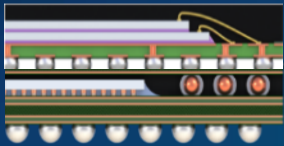
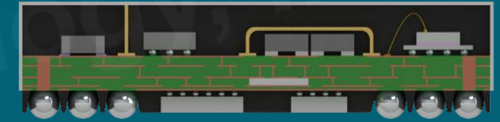
Amkor's 3D & 5G Packaging Innovation

Packaged Embedded Die: Large complex modular systems

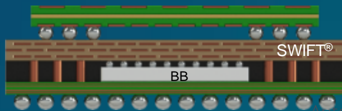


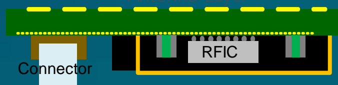
Multi-die +
Package Stacking



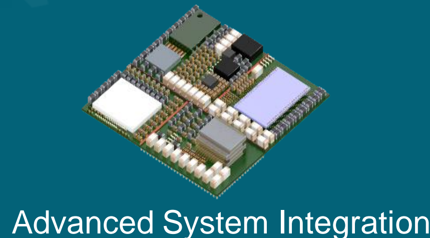
Compartmental/Conformal
Shield & Dual Side Mold

Multi-level
Packaged Embedded Die

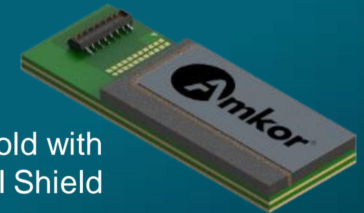




Antenna
in Package



Advanced System Integration



Partial Mold with
Partial Shield

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Significant R&D Investment

- Outstanding engineers
- Localized design services
- Dedicated assembly lines
- Complete toolbox of engineering services
- Continuous innovation

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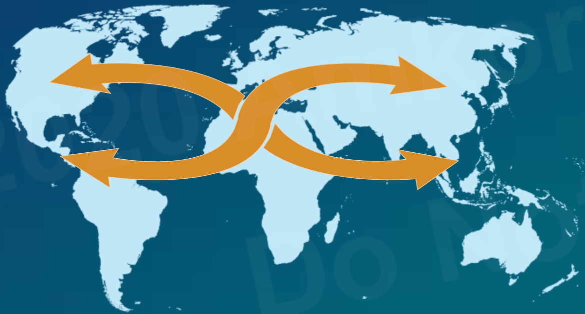
Supply Chain: Globalization to Localization?

Before

- Global production networks
- Global supply chain networks
- Minimized stock strategies



- Global delivery footprint
- Customer-specific variant
- Limited risk management

After

- Localized production networks
- Local supply chain networks
- Local warehouse and reserve strategies

- Build where you sell
- Variant reduction
- Expect the unexpected

Source: "COVID-19 impact – A Yole Perspective". Yole Développement. www.yole.fr.

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The Future of Advanced Packaging

- Innovation milestones
  - Multi-sided assemblies
  - Advanced materials
  - Electrical microsystems
  - Extreme density
- High capital outlays
- Pace of change is accelerating
- Time to market is critical
- Heterogeneous packaging will extend Moore's Law

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Enabling **the** Future

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