

Semiconductor Industry

*Entering a New Era as the World Finds
Ways to Extract More Value from Chips*

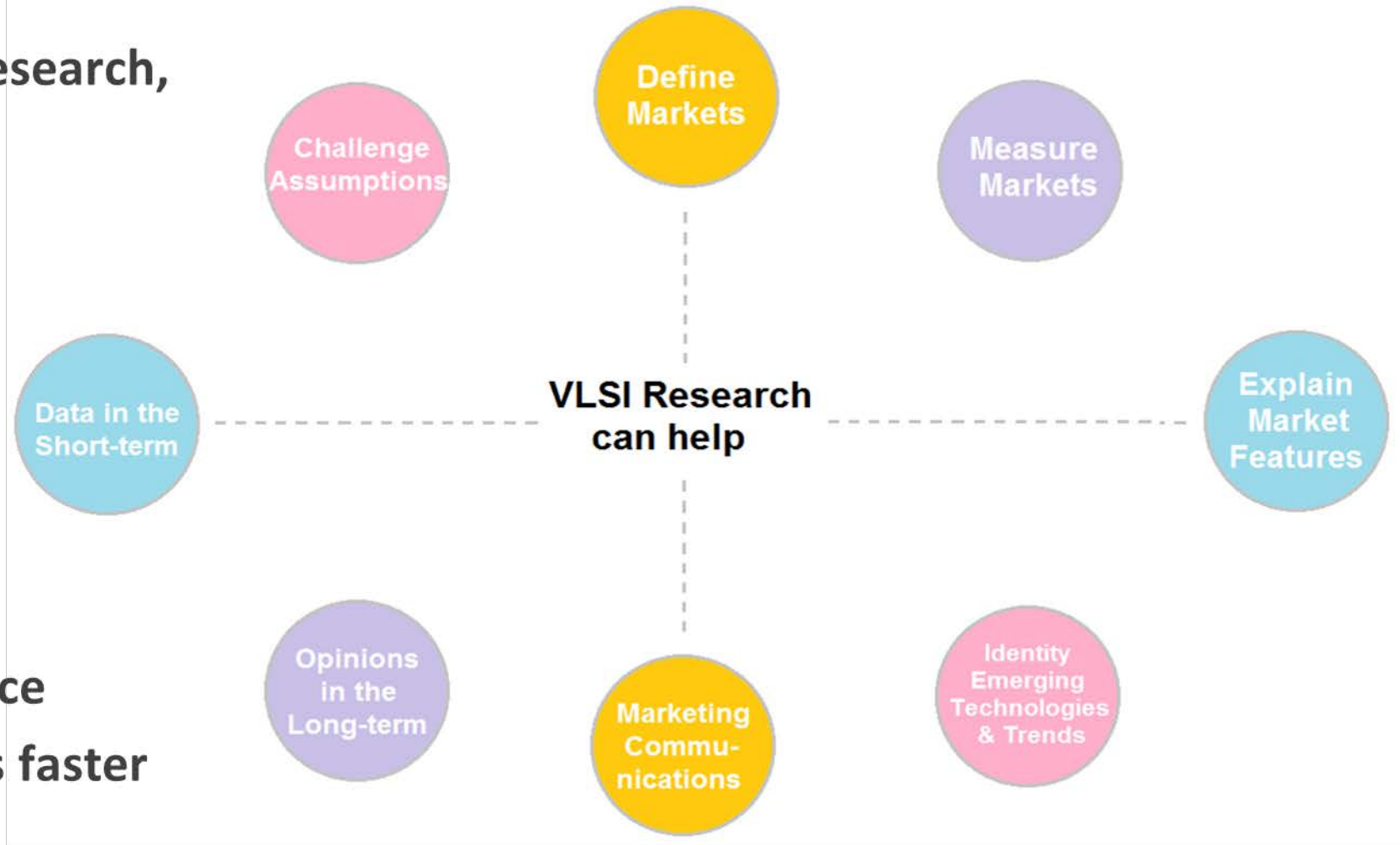
VLSIresearch

John West

Lin Fu

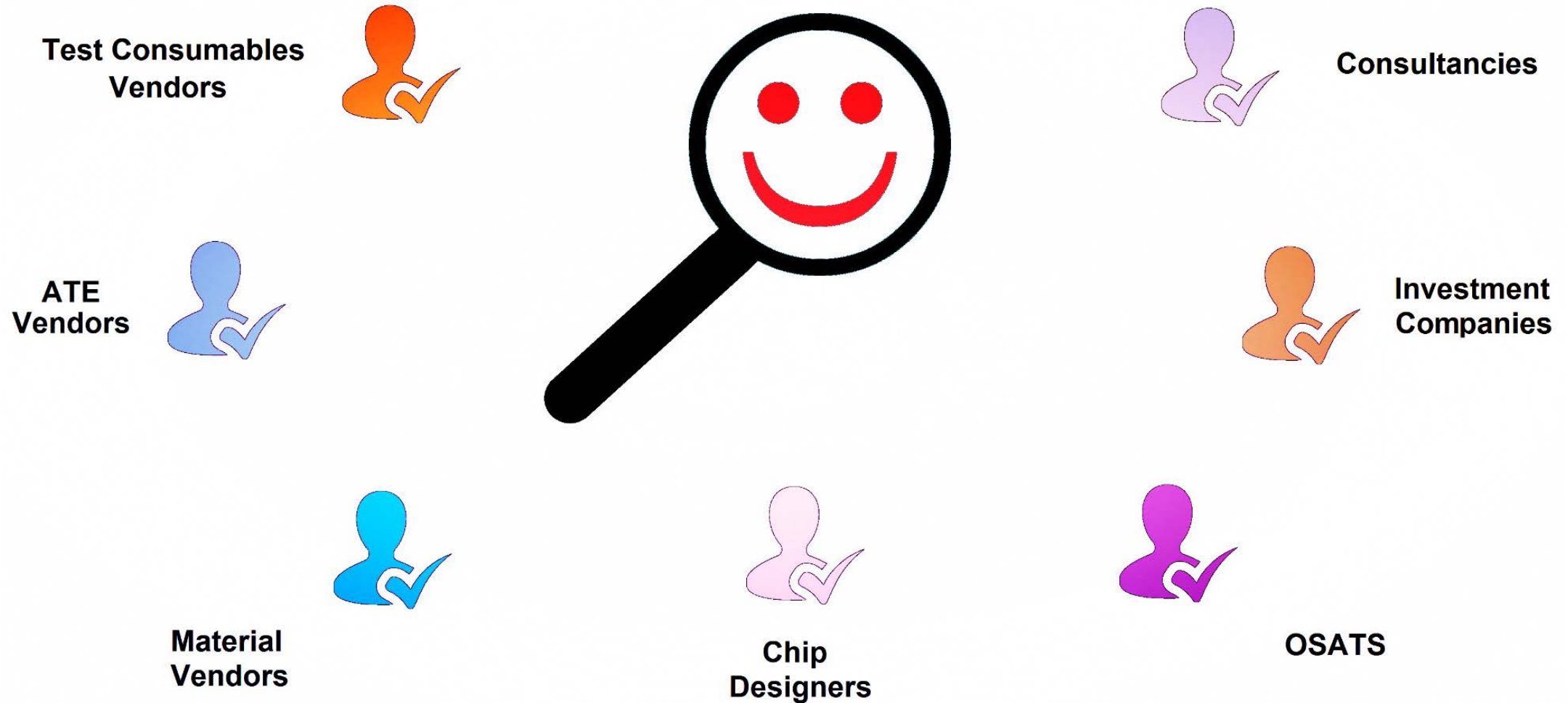
Probe Card Market --- 22 Years Experience

For Probe Card Market Research,
We Can help ...



... provide intelligence
to make better decisions faster

Over 40 Customers for Probe Card Reports



Overview



1

New Era of End Demand

2

Global IC Market

3

Asian IC Market

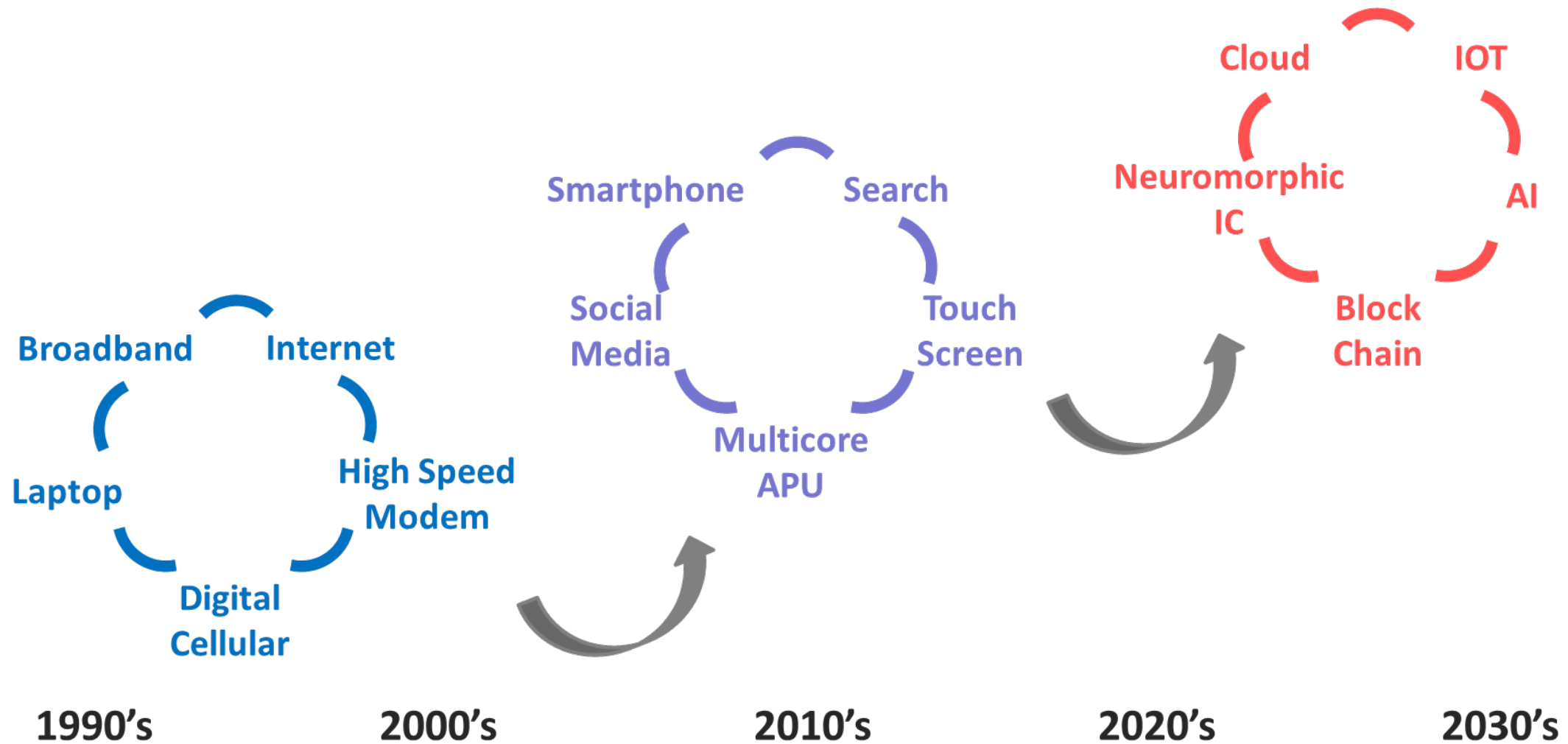
4

Global Probe Card Market

5

Summary

Virtuous Cycles of Demand



New Era of Data

**Data
Collection**



IOT

**Data
Transfer**



5G

**Data
Analysis**



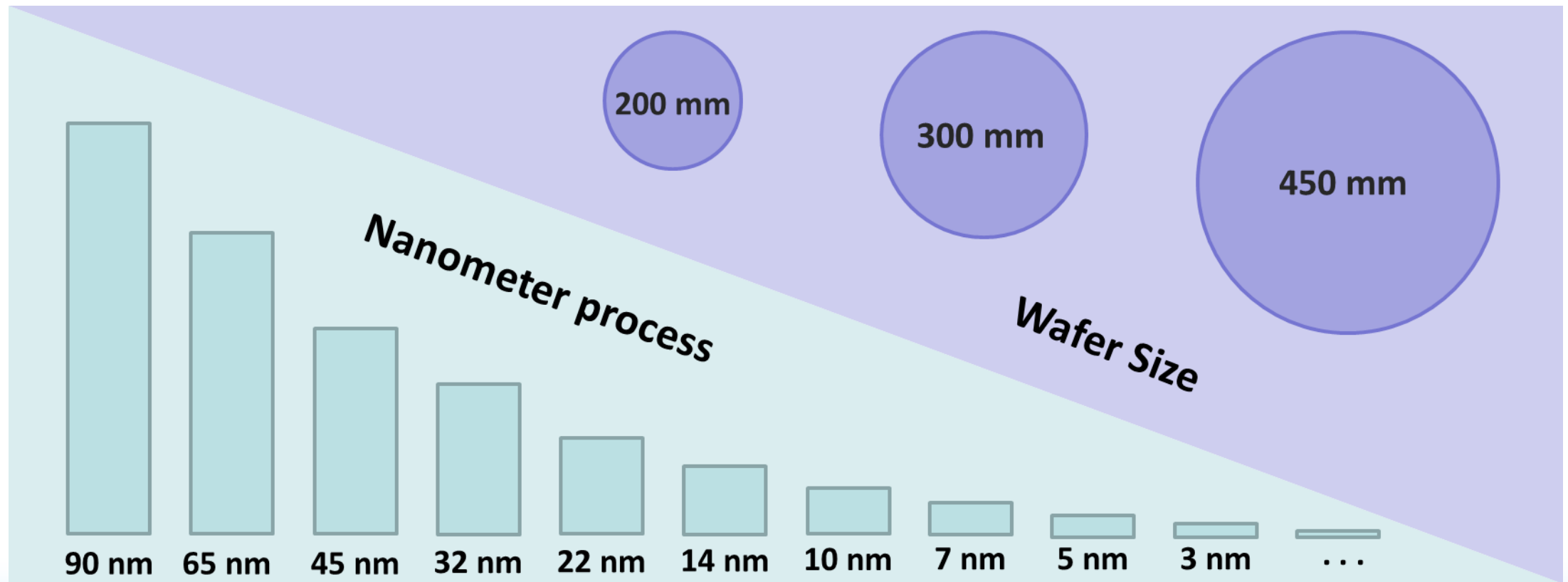
CPU + GPU

**Data
Storage**



Data Center

Technology Roadmap



Technology Roadmap



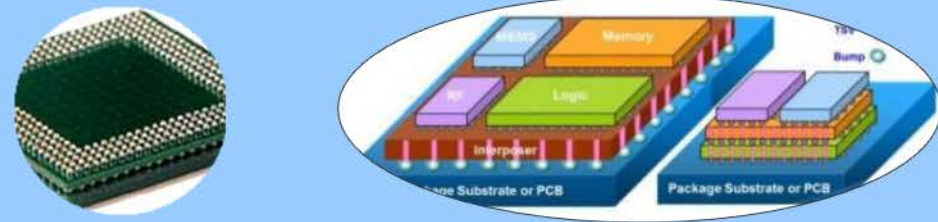
Area Array Package:



BGA, *u*BGA, QFN, CSP ...

Packing Component

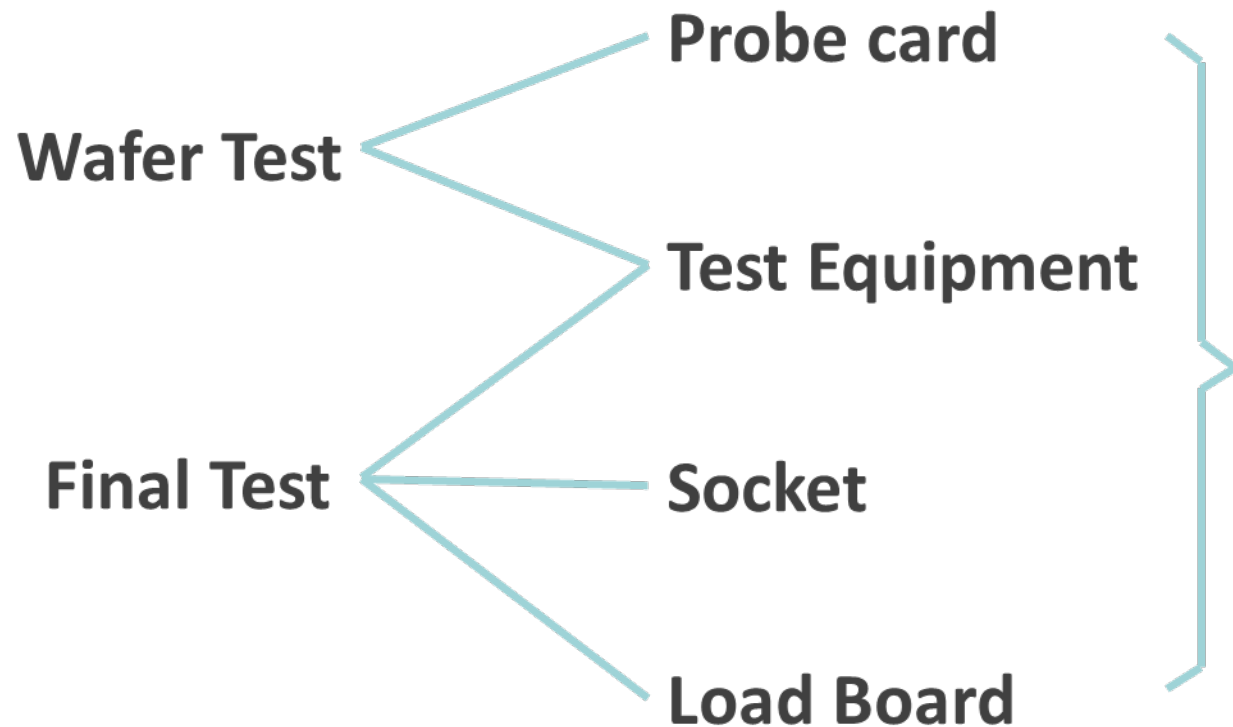
Stacked Package:



POP, PIP, SIP, TSV 2.5D IC, TSV 3.0D IC ...

Packing System

Technology Roadmap

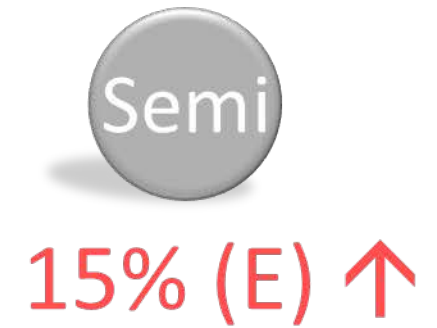
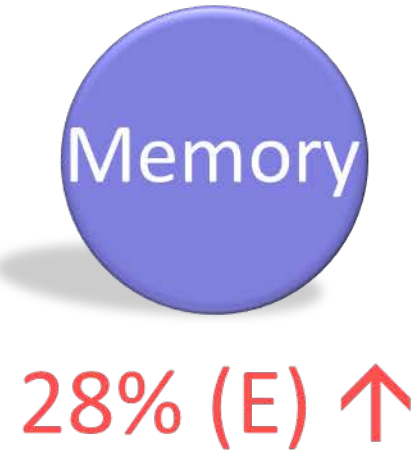
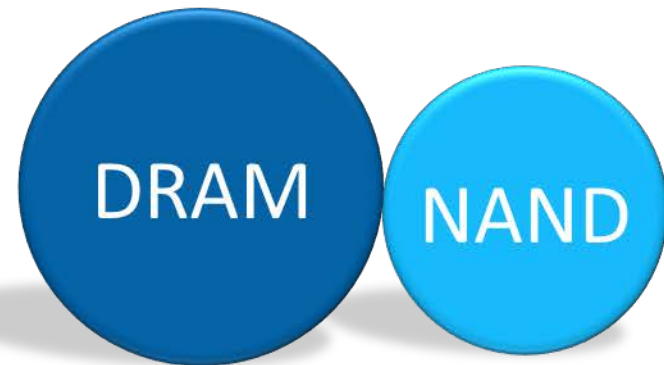


Continuous improvement of performance for supporting the test:

- smaller size,
- higher pin count,
- finer pitch,
- higher frequency or testing speed,
- larger temperature range

Overview of IC Market 2018

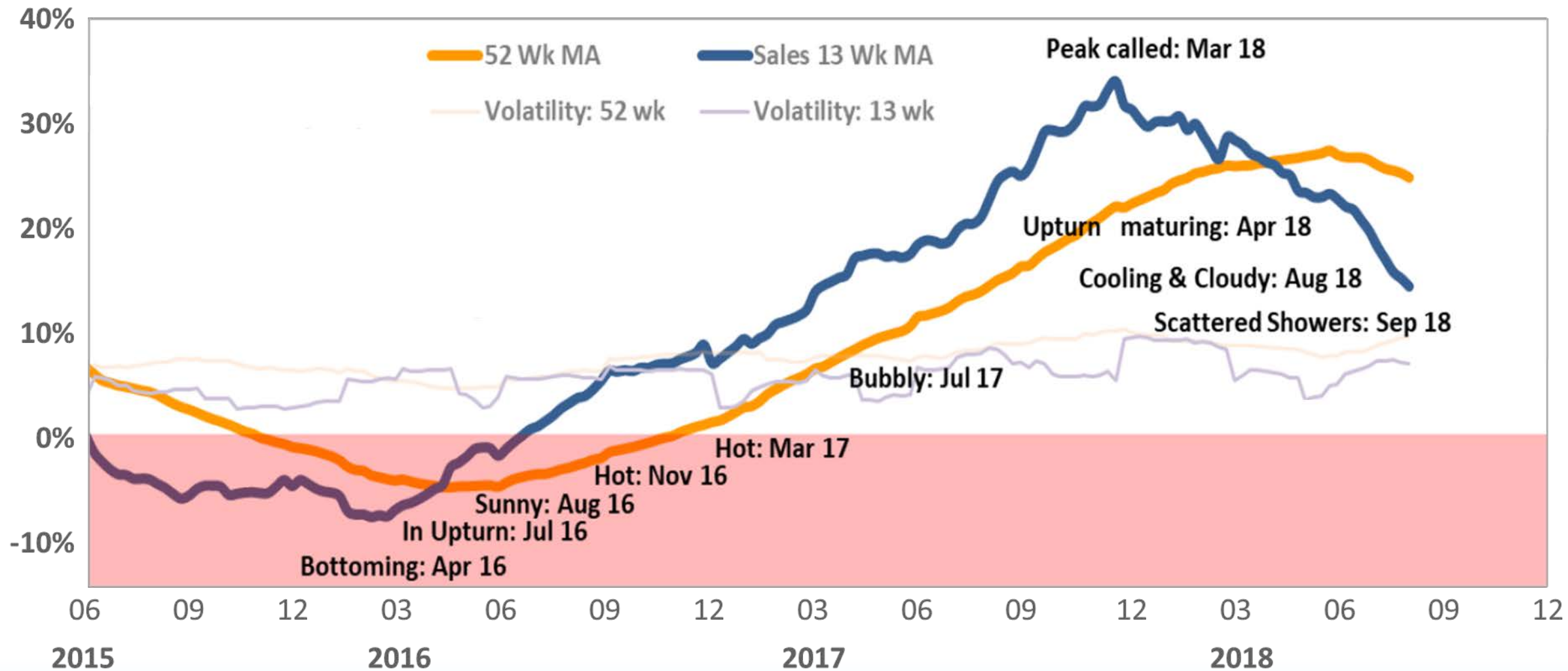
**Key
Revenue
Drivers**



Estimated IC Sales > \$400Bn

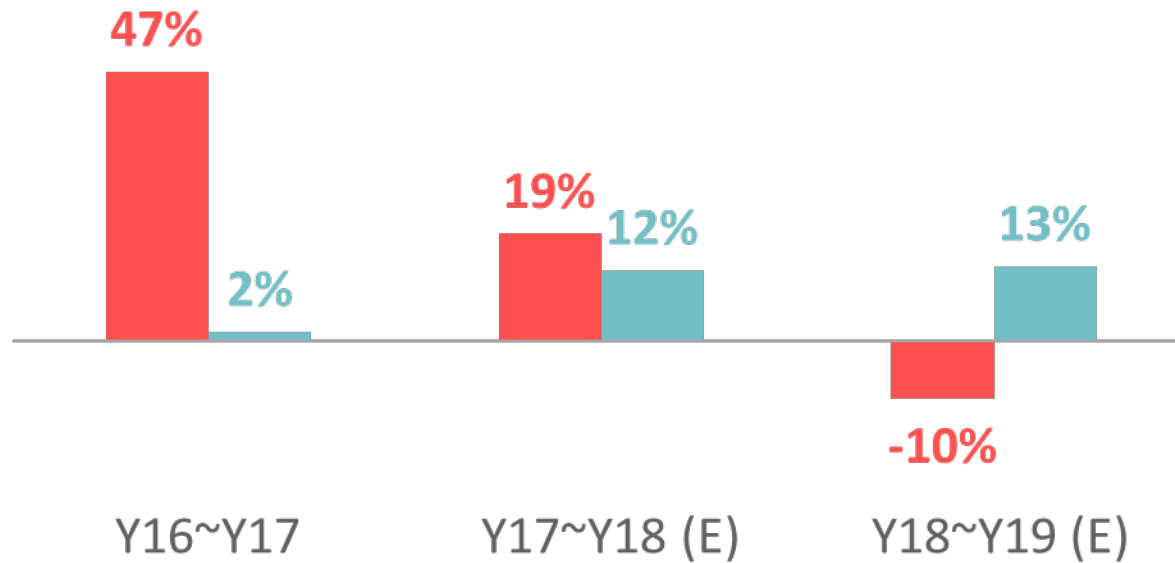
Estimated Semi Sales > \$480Bn

IC Sales Growth: Weekly Moving Averages

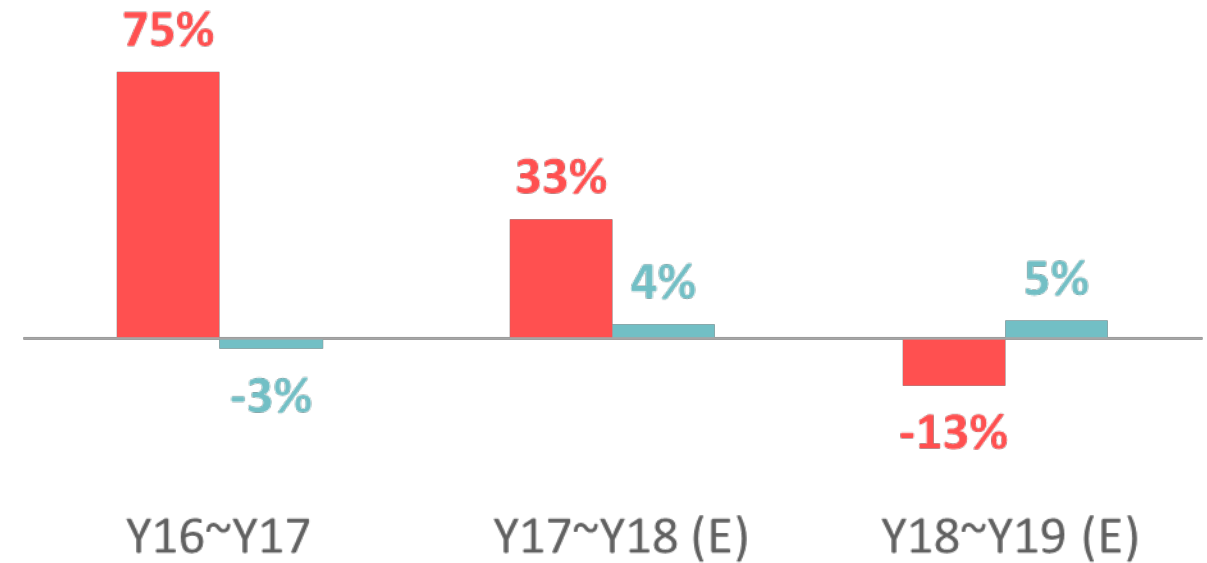


Outlook of Memory Market

NAND Flash Growth: Revenues vs. Units



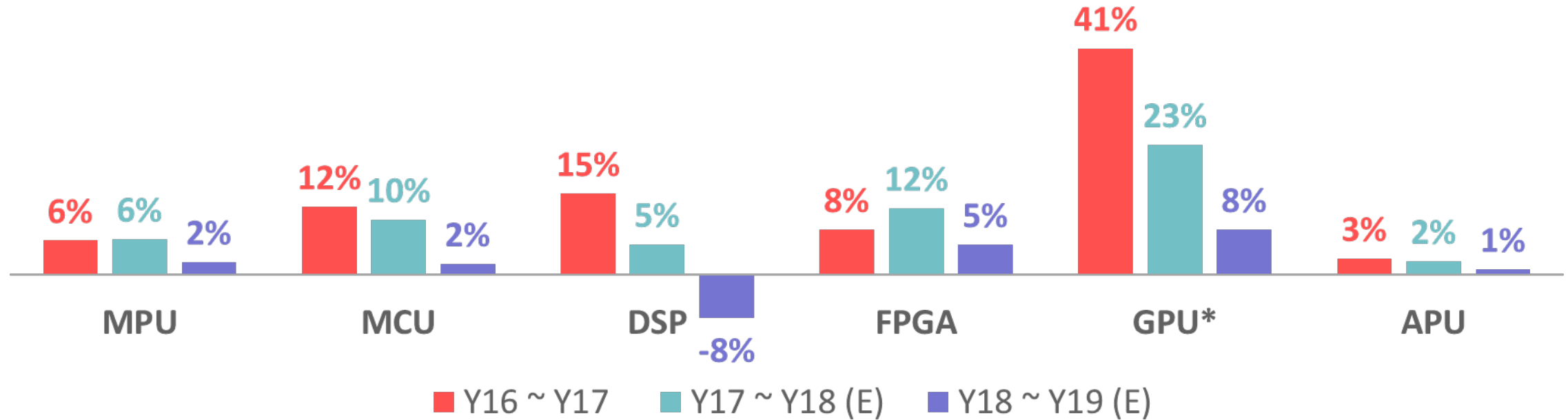
DRAM Growth: Revenues vs. Units



- Memory market growth in 2017 was price driven
- Weakening NAND and DRAM prices will slow down revenue growth in 2018 and may result in negative revenue growth in 2019 even if unit shipments steadily increase

Outlook of Non-Memory Market

Revenue Growth of Non-Memory Market



- Graphics processor sales strong due to AI and Blockchain
- Applications processor sales weaken as smartphone and tablet sales mature

ICs Consumption vs. Supply by Region 2018 (E)



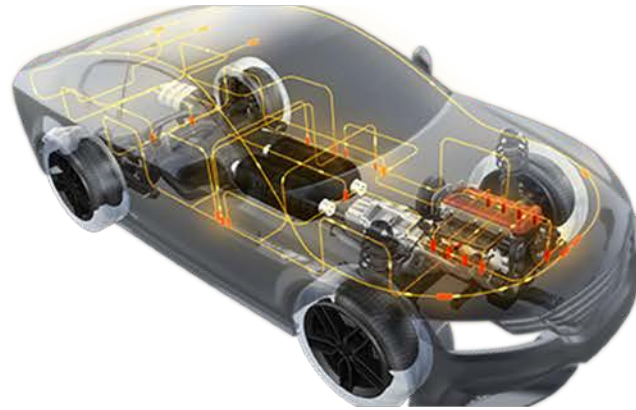
	Consumption	Supply
China	\$160B	\$20B
Japan	\$30B	\$25B
South Korea	\$25B	\$90B
Taiwan	\$50B	\$50B

Japanese Market



Advanced Image Sensor Technology

will be widely used in AI, IOT, driverless vehicles



Mature Automotive Electronics Market

strong demand on power chips



Devaluation of Japanese Yen

helpful to exports and increases international competitiveness

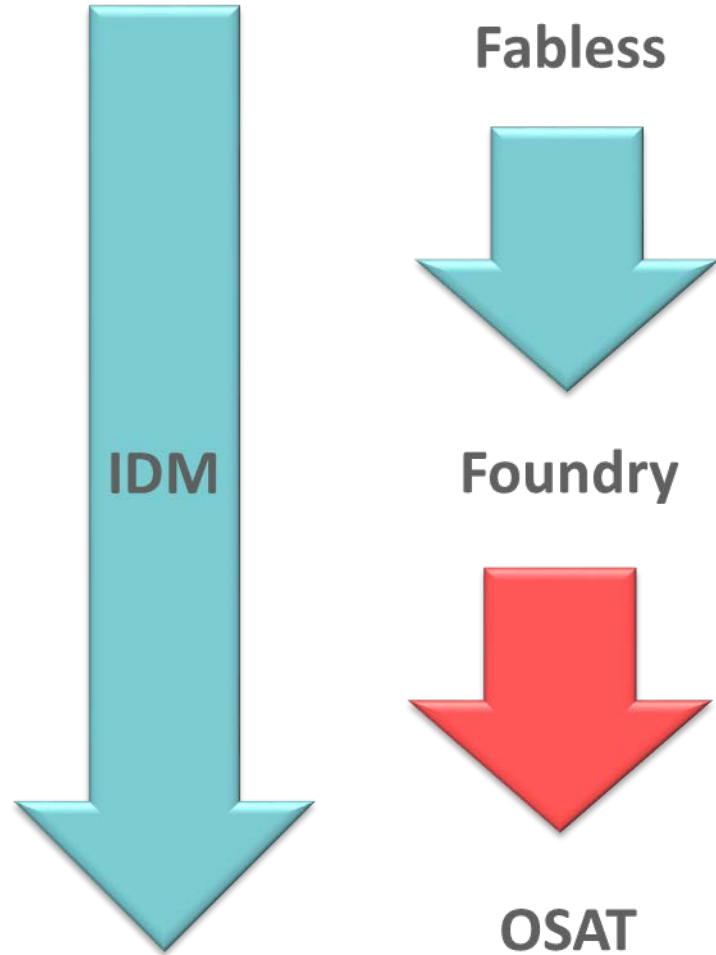
Korean Market

- Korean test consumables' suppliers concentrate on the local market, more than 90% of probe cards and 80% of burn-in sockets are consumed locally



- Strongly dependent on two chip designers: Samsung and SK Hynix. (Main growth drivers for elastomer socket business)
- Samsung started to reduce the cost of test in 2018, which had a negative effect on Korean suppliers

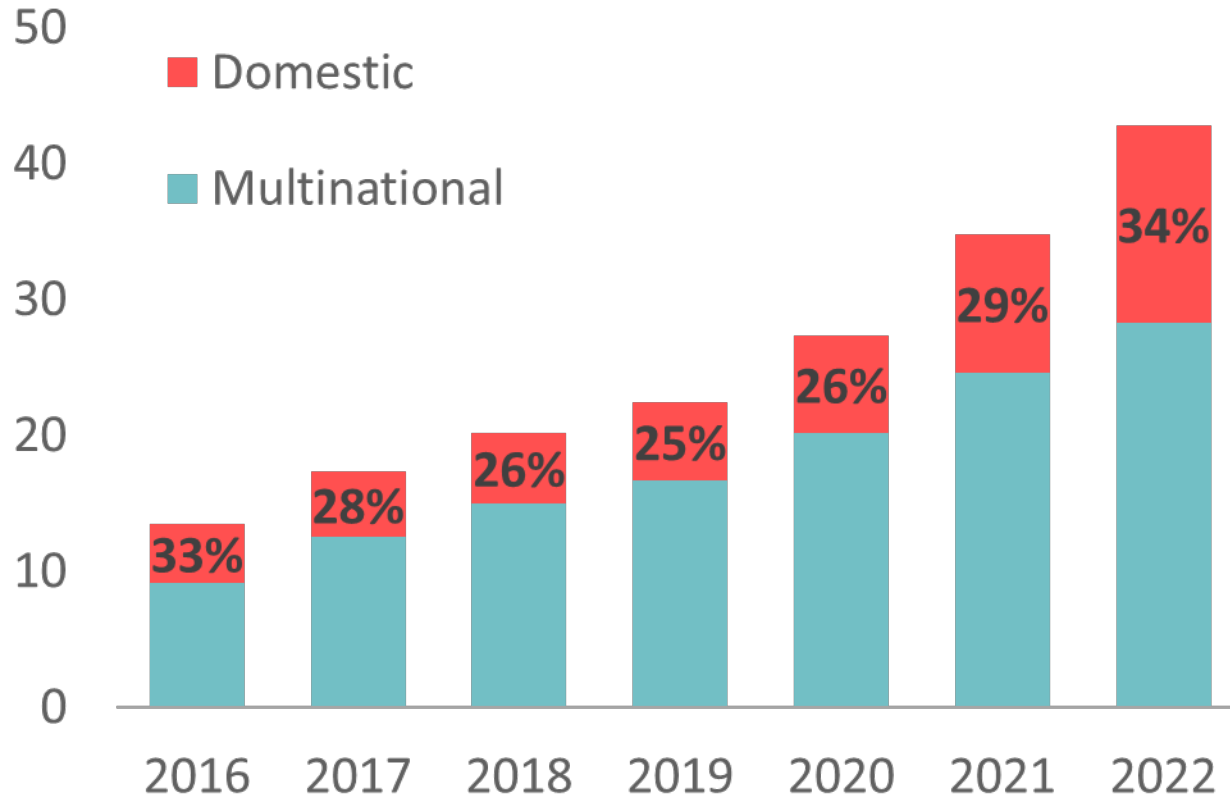
Taiwanese Market



- Major Foundries and OSATs are located in Taiwan, but no powerful local IDM or fabless companies except MediaTek
- Most decisions still heavily influenced by companies outside Taiwan, especially the North American chip designers
- Chinese chip designers also prefer to use Taiwanese foundries

China-Sourced IC Sales

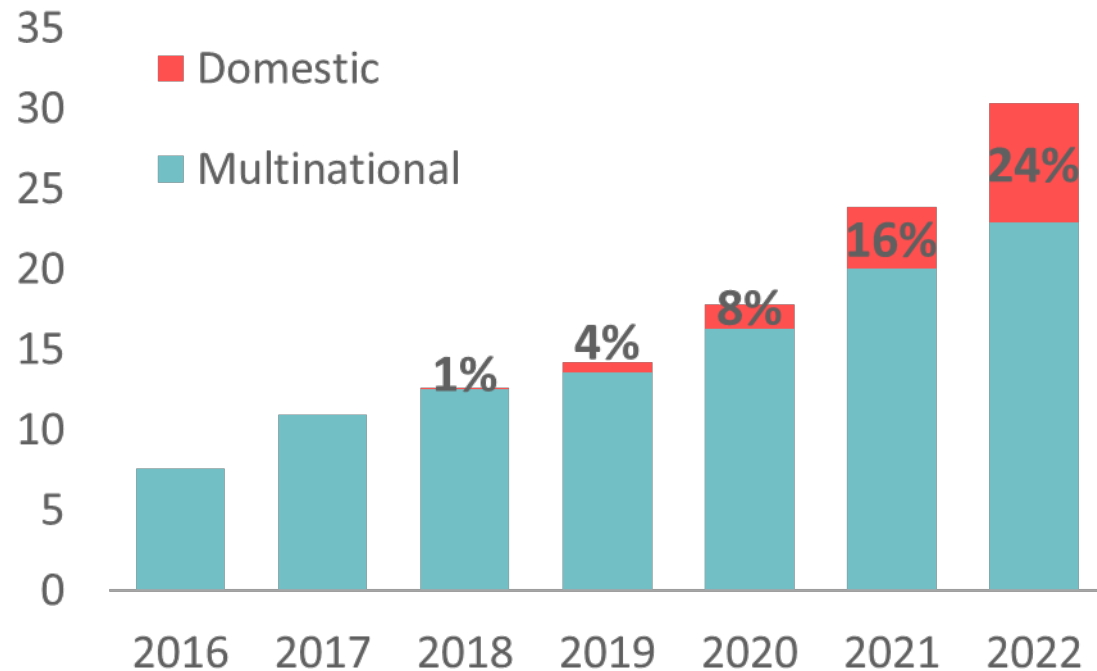
China - Sourced IC Sales, \$B



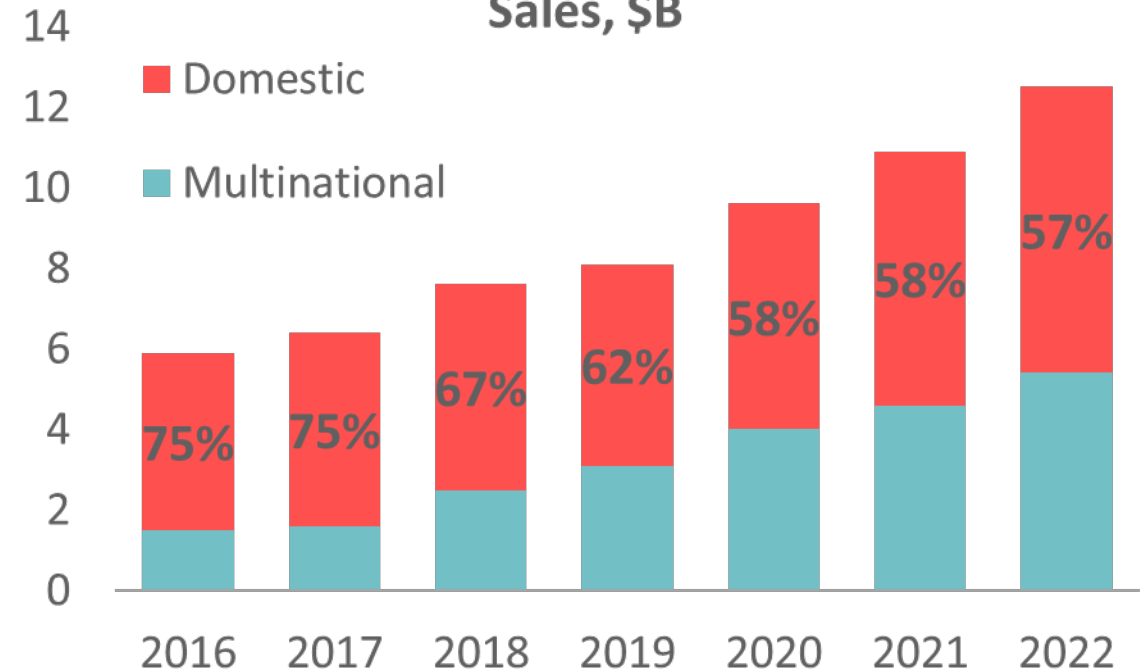
- \$17.4B in 2017
 - 28% of sales domestic
- \$42.8B in 2022 at CAGR ~ 20%
 - 34% of sales domestic
- Domestic 2017-22 CAGR ~ 25%
- Multinational 2017-22 CAGR ~17%

China-Sourced ICs: Memory & Non-Memory

China - Sourced IC Memory Sales, \$B

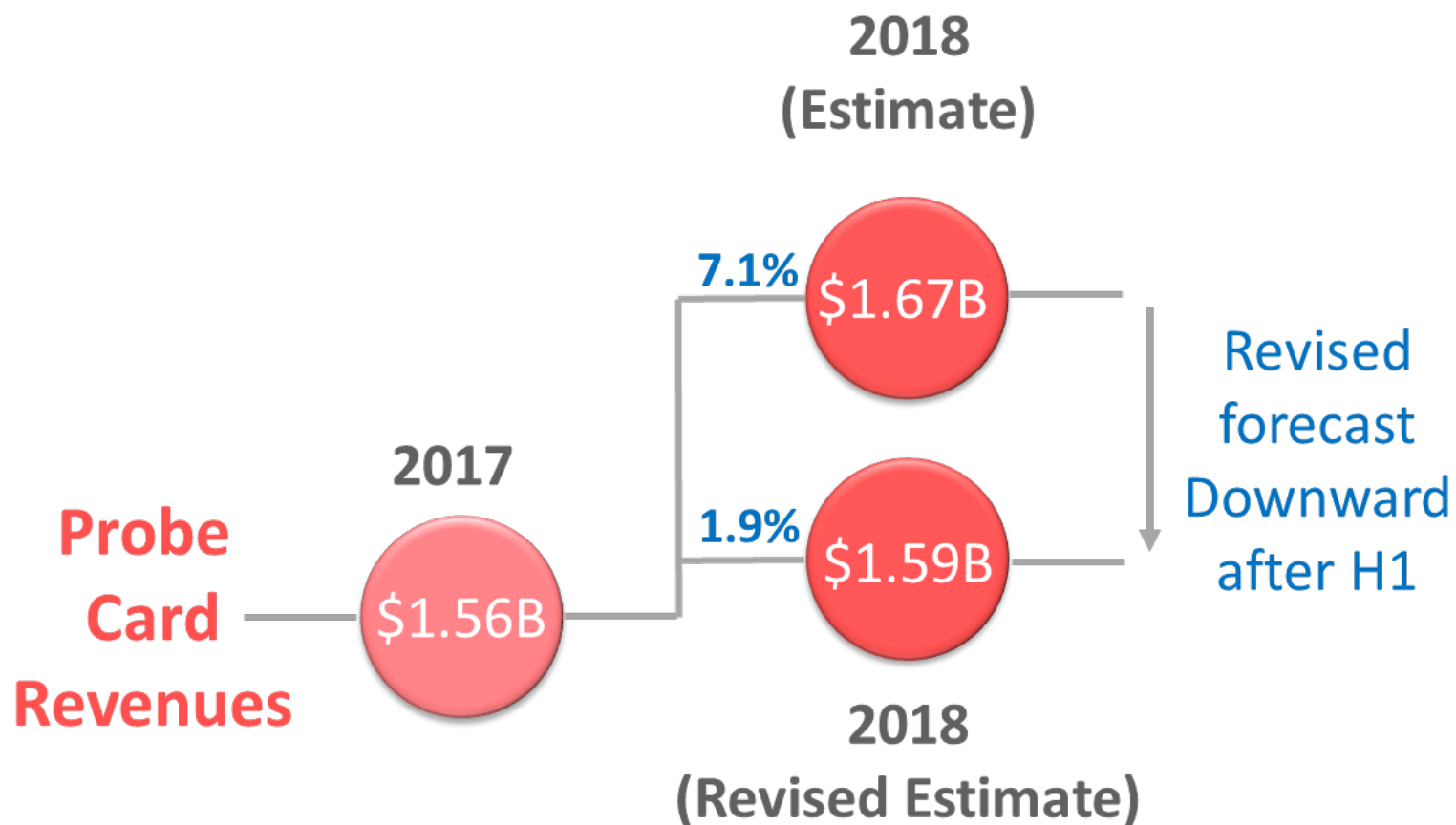


China - Sourced IC Logic & Foundry Sales, \$B



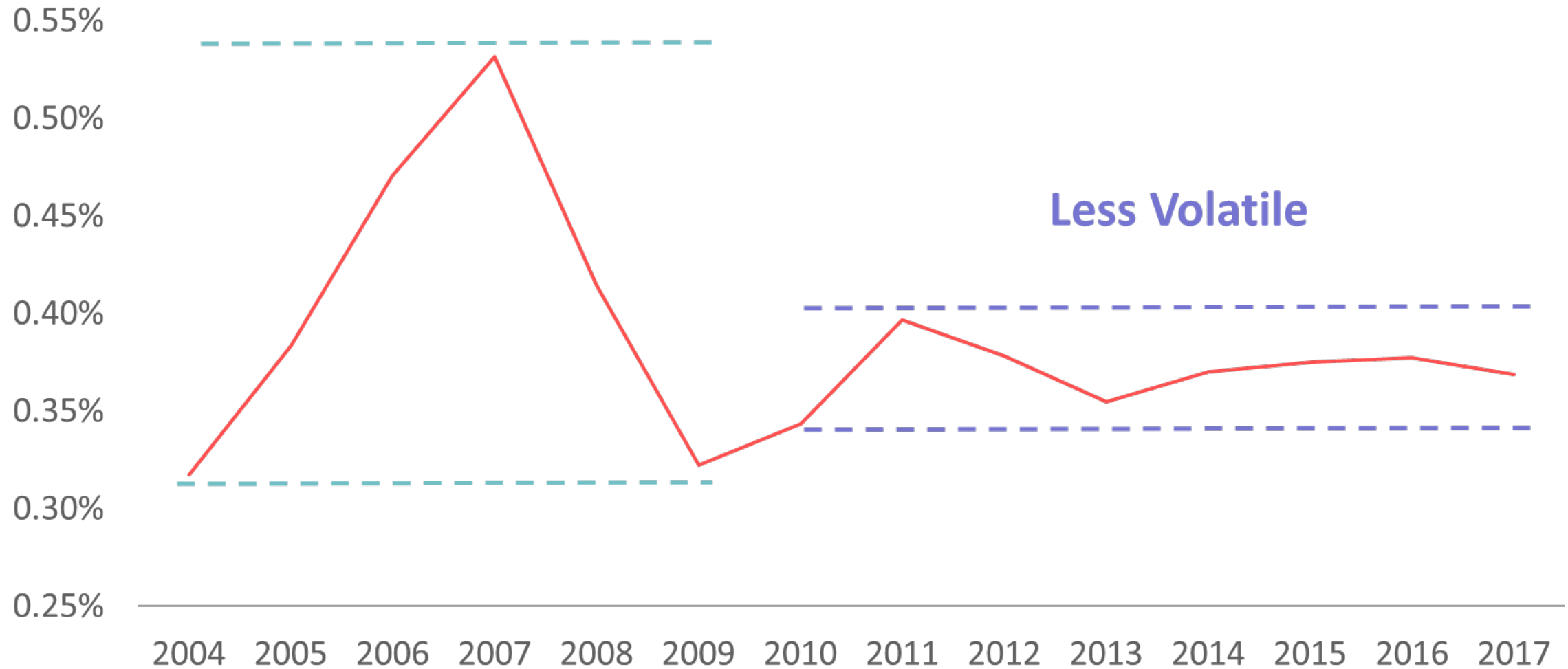
- Most of China sourced IC sales by domestic vendors are for non-memory applications
- Domestic memory Capex will increase significantly over the next five years

Probe Card Market Overview

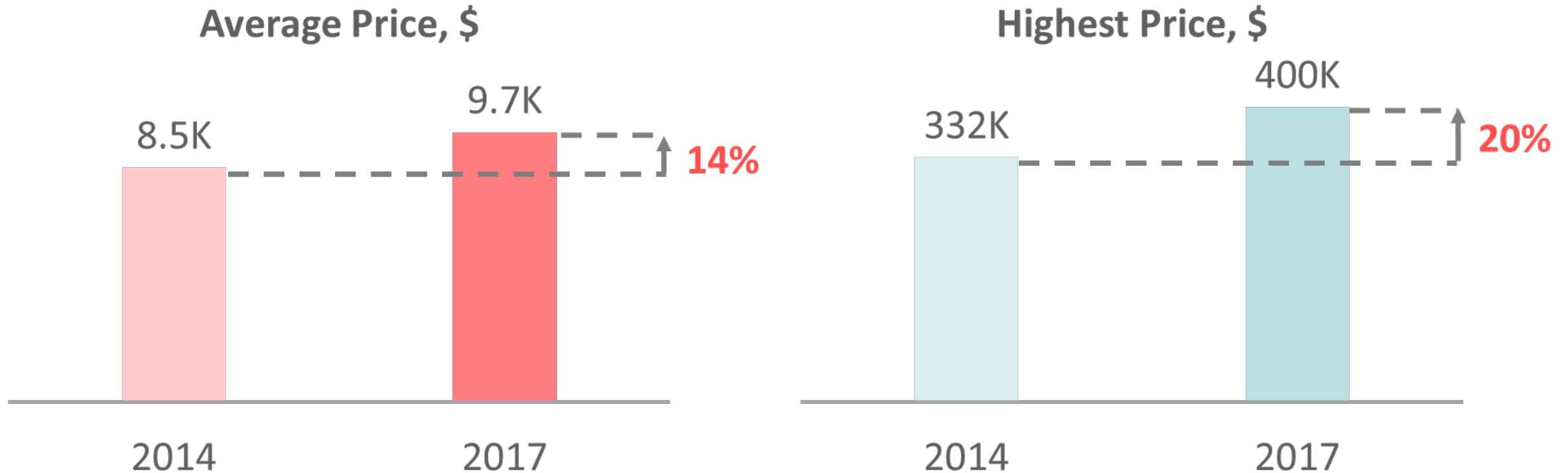


- 2018: IC market is still hot, with relatively low growth rate compared with 2017. However, sales of probe cards in H1 were not as good as we expected.
- 2019: A correction year
- 2020: A recovery year, 5G era coming

Probe Card Spend % of Total Semi Revenue



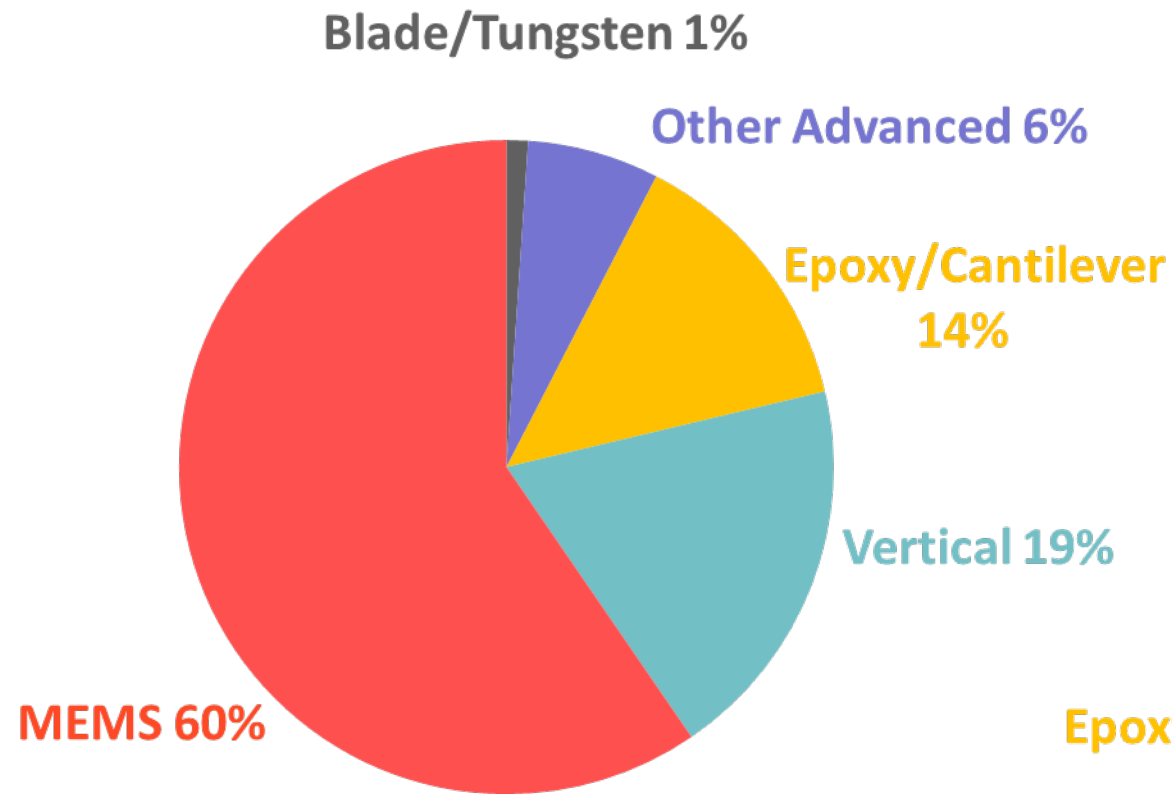
Probe Card Prices



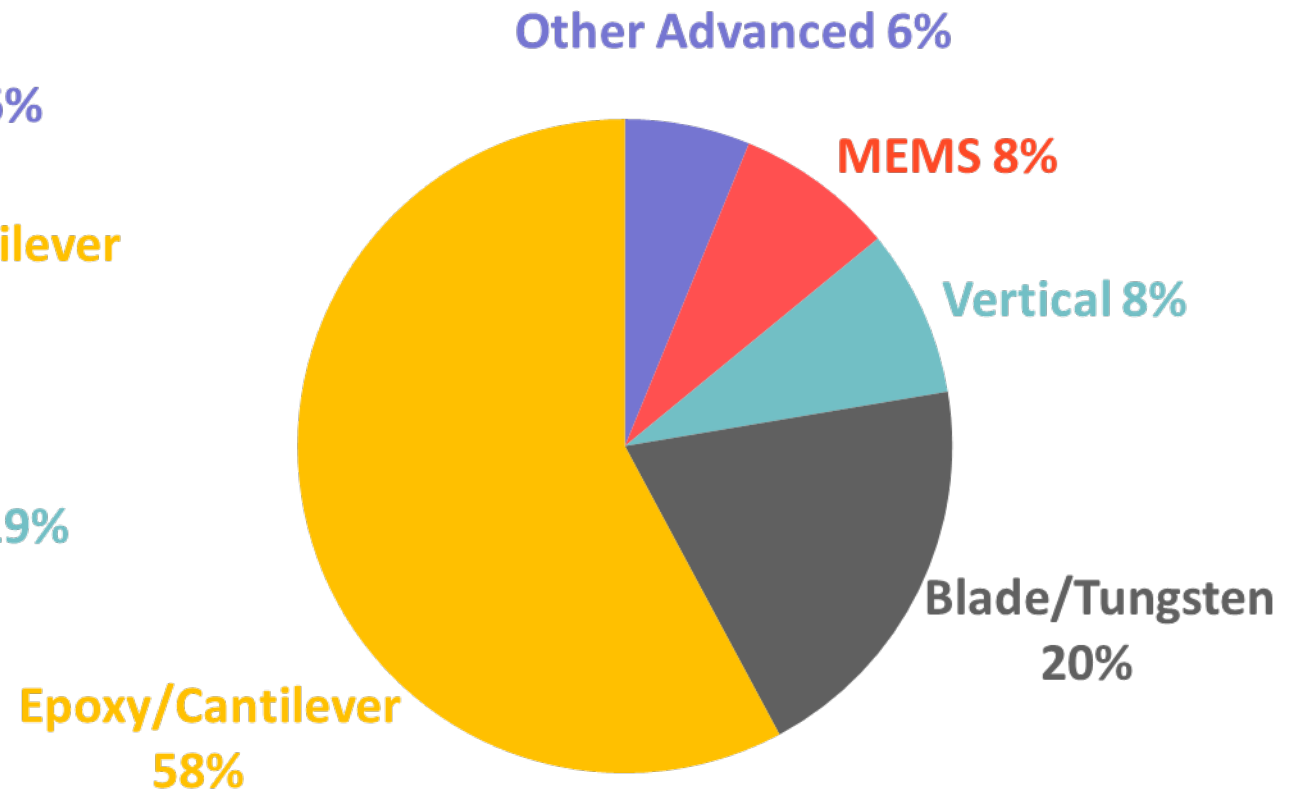
- Very high end probe card price growth greater than average price growth

Revenue and Unit Distribution

Revenue Distribution, 2017

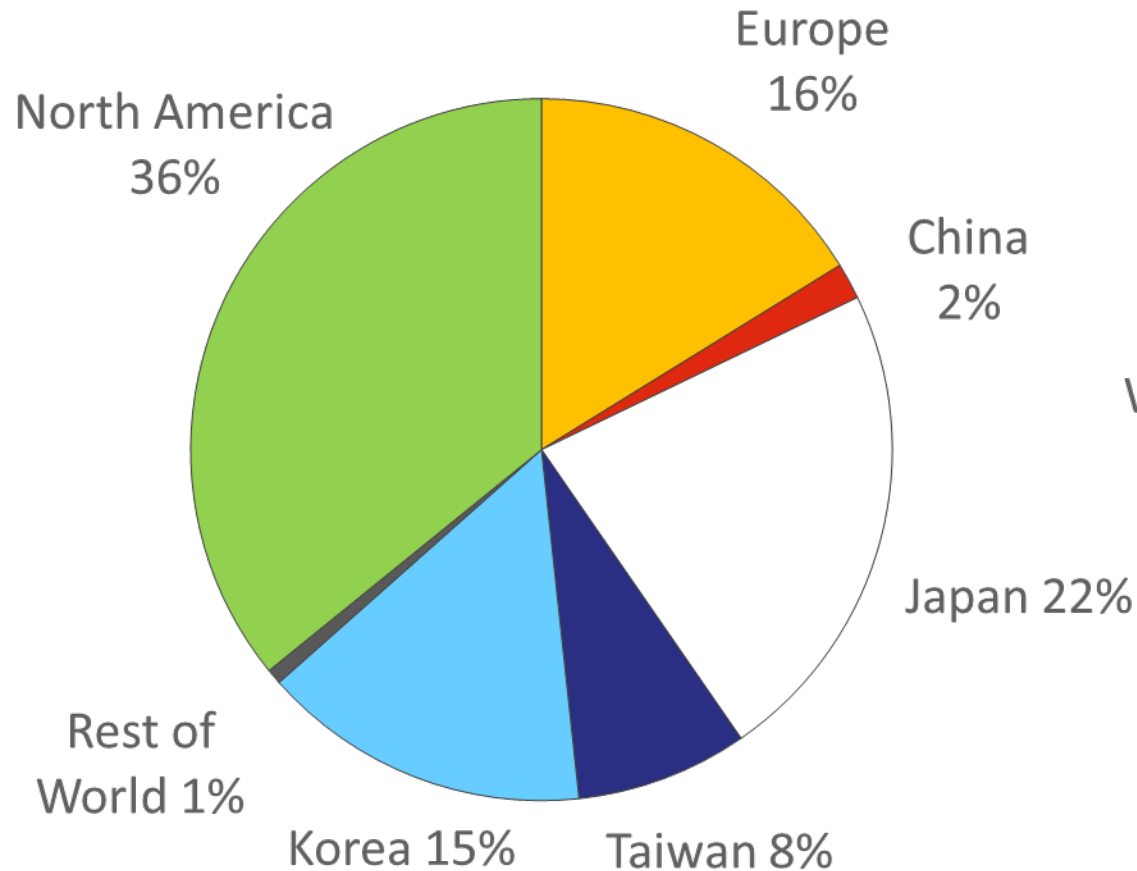


Unit Distribution, 2017

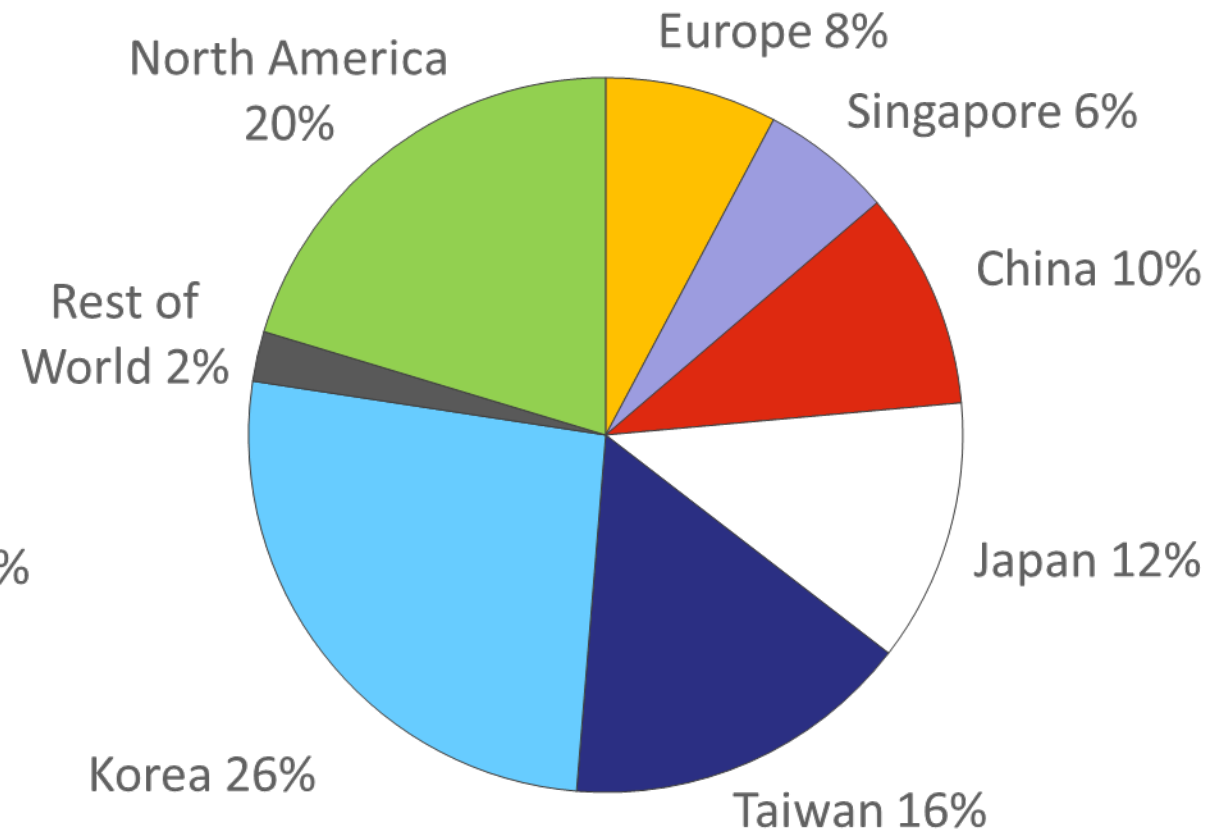


Supply and Consumption Distribution

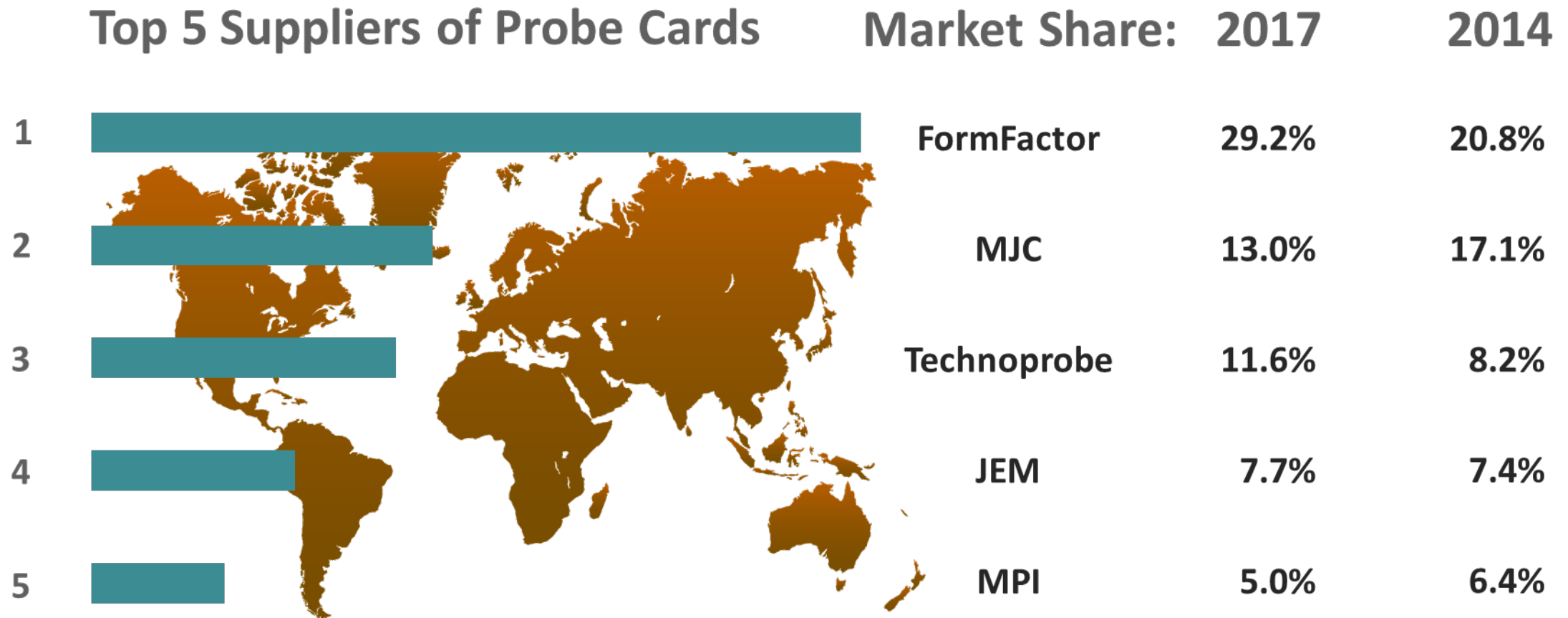
Supply Distribution, 2017



Consumption Distribution, 2017



Top Probe Card Suppliers



Summary

- 2018 is still expected to be another great year even if the sales growth slows down.
- 2019 is likely to be a correction year. As new memory capacity comes on line, rapidly falling memory prices may result in an overall semiconductor sales decline.
- From 2020, new end demand will gradually mature and become major market drivers, which will make the semiconductor industry enter a new era.