SW Test Workshop

Semiconductor Wafer Test Workshop

Probe Card Market Update

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Overview

Semiconductor Market

2017

2018

Probe Card Market

By Type

By Application

Price

Capacity

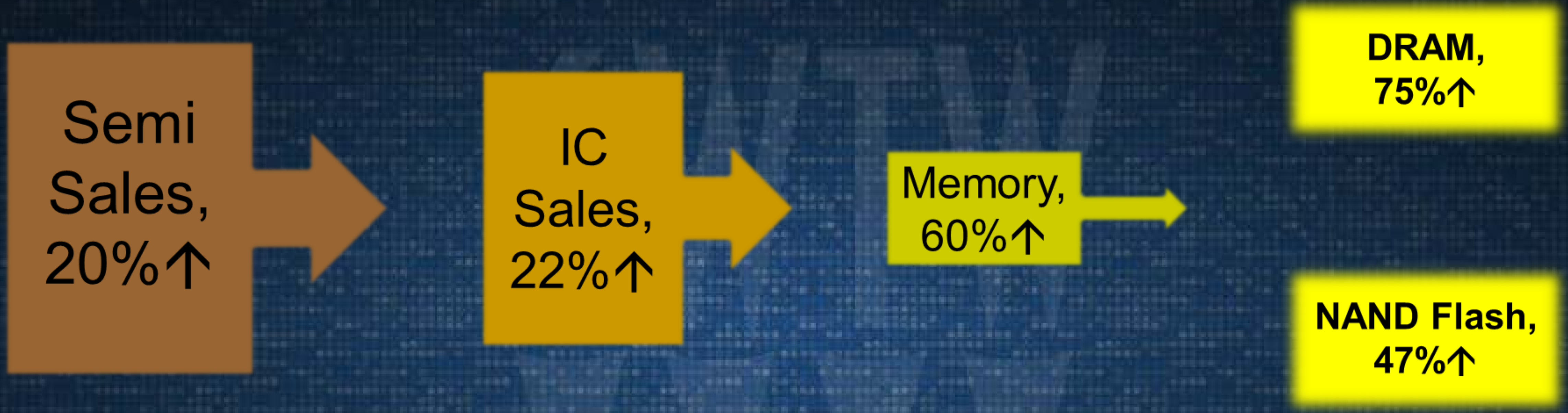
Business Model

Regional Characteristics

Industry Consolidation

Summary

2017 Semiconductor Market

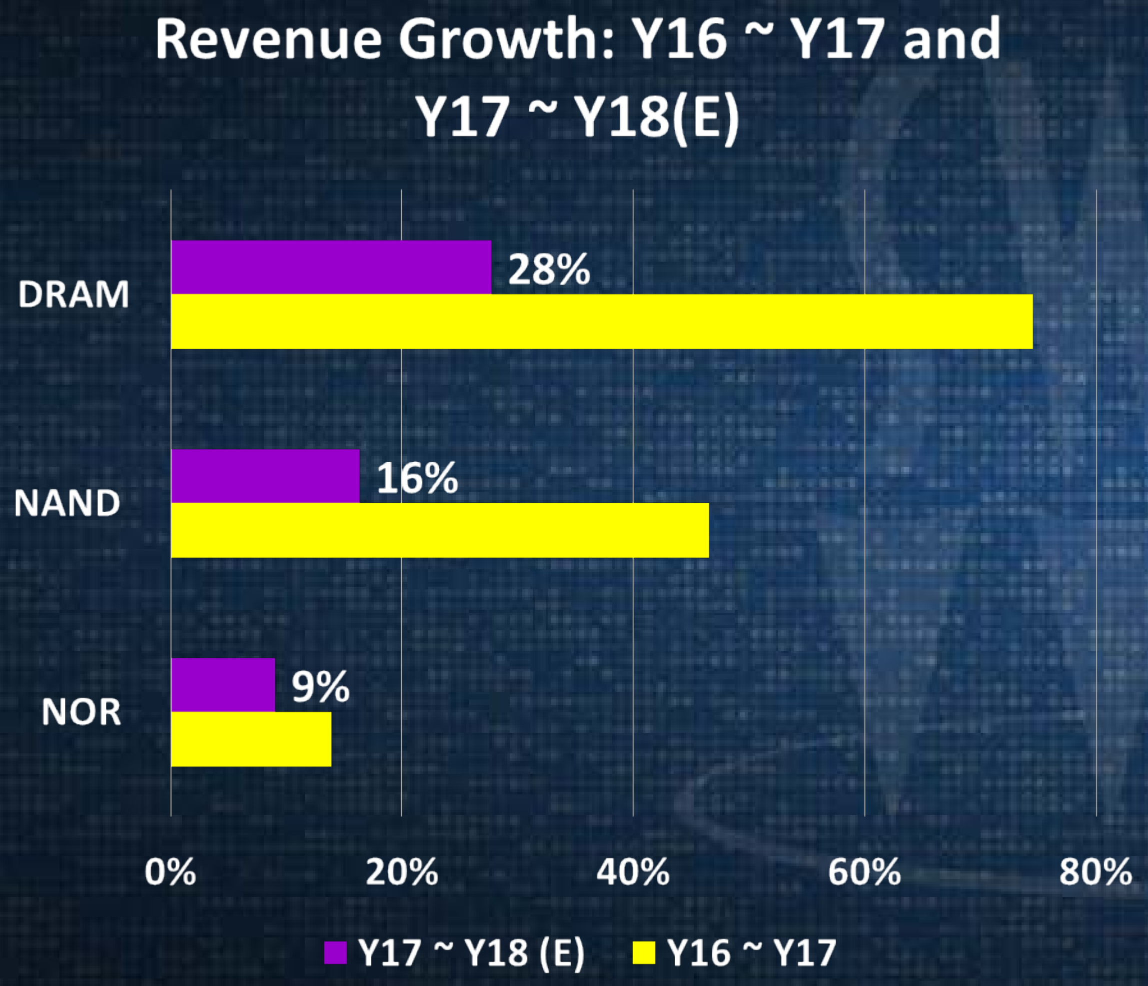


- **2017 was an exceptional year for semiconductors with sales exceeding $400Bn**
- **Memory revenues increased 60% in 2017 compared to revenues in 2016. Key drivers: DRAM and NAND Flash**

2018 Semiconductor Market Outlook

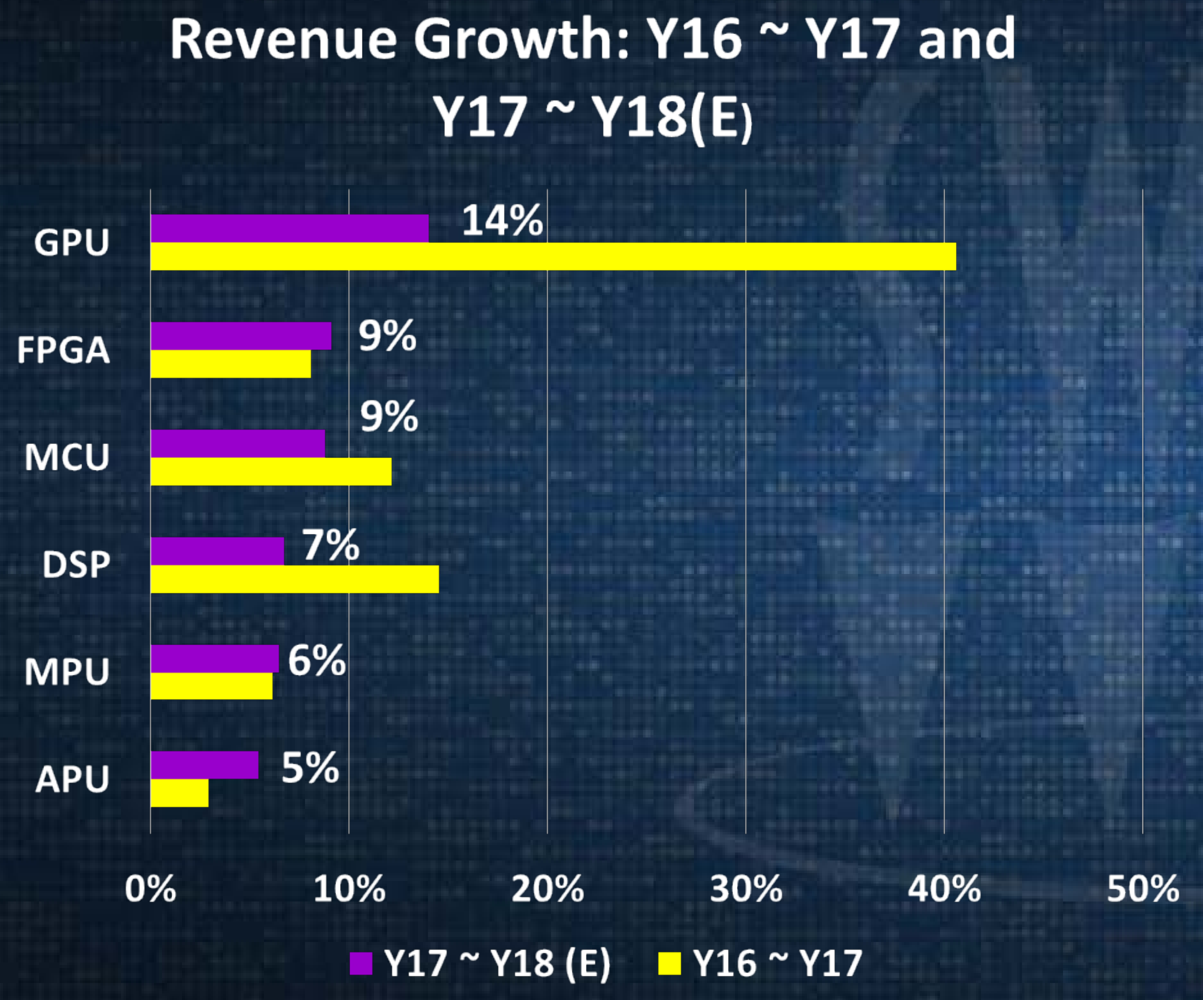
- **Peak growth in semiconductors reached at end of March 2018**
  - Sales of semiconductors in the last week of March 2018 were 30% higher than the same week in 2017
- **Weakening of demand due to falling memory prices**
- **Underlying demand still strong**
- **Chip inventories at a healthy 1.2 months**
  - Currently growing fast (in line with demand) but could spike if demand drops suddenly
- **Expect growth of 12.5% in 2018**

Semiconductor Memory Market



- DRAM added $30Bn to semiconductor revenues in 2017
- DRAM will be biggest growth driver in 2018
- Weakening NAND prices will affect NAND growth
- DRAM, NAND Flash and NOR Flash are expected to grow in 2018

Semiconductor Non-Memory Market



- Logic markets set to grow steadily
- Graphics processor sales strong due to AI and Blockchain
- Applications processor sales weak as smartphone and tablet sales mature

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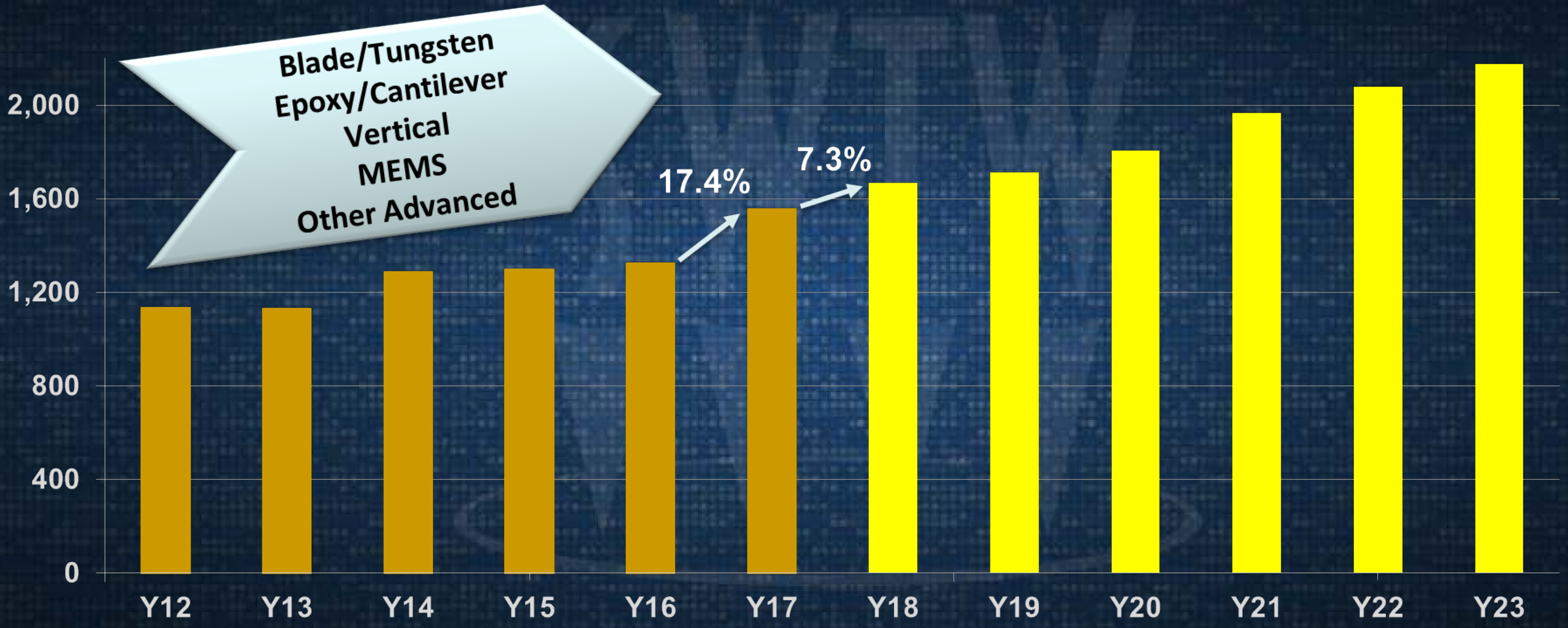
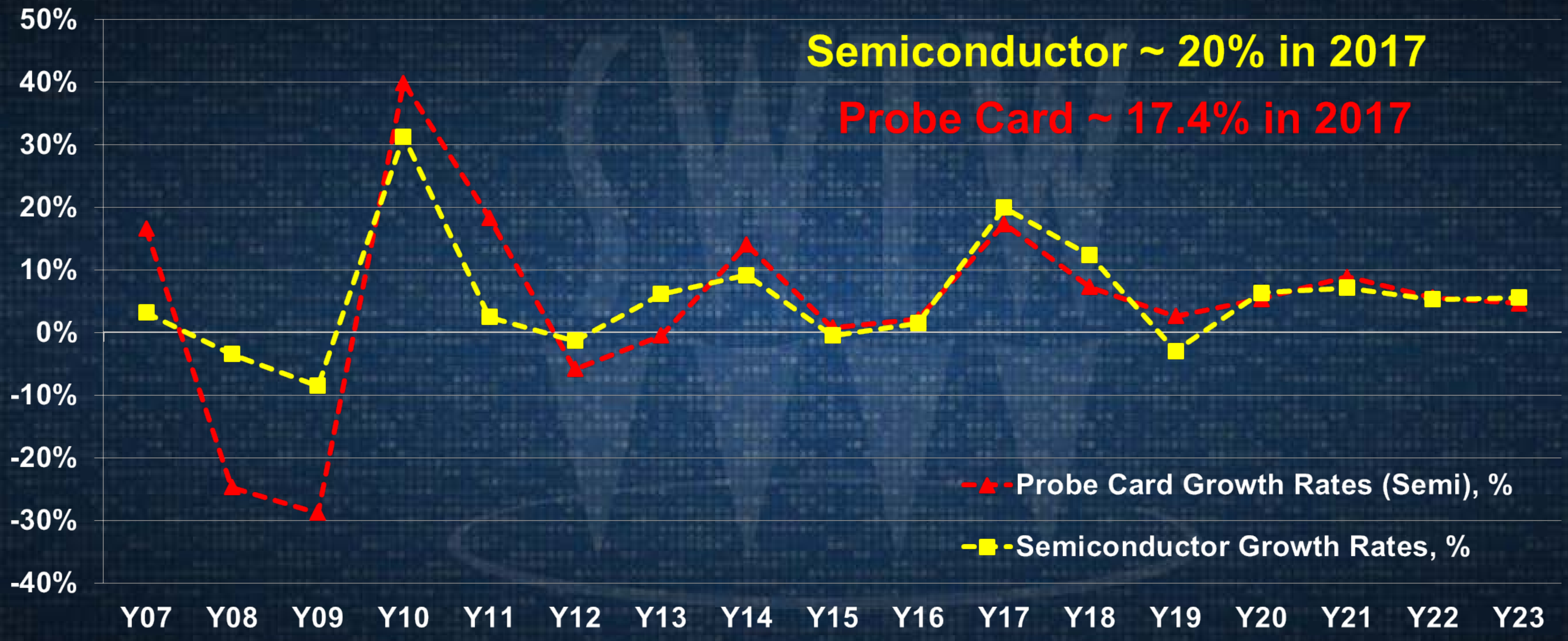
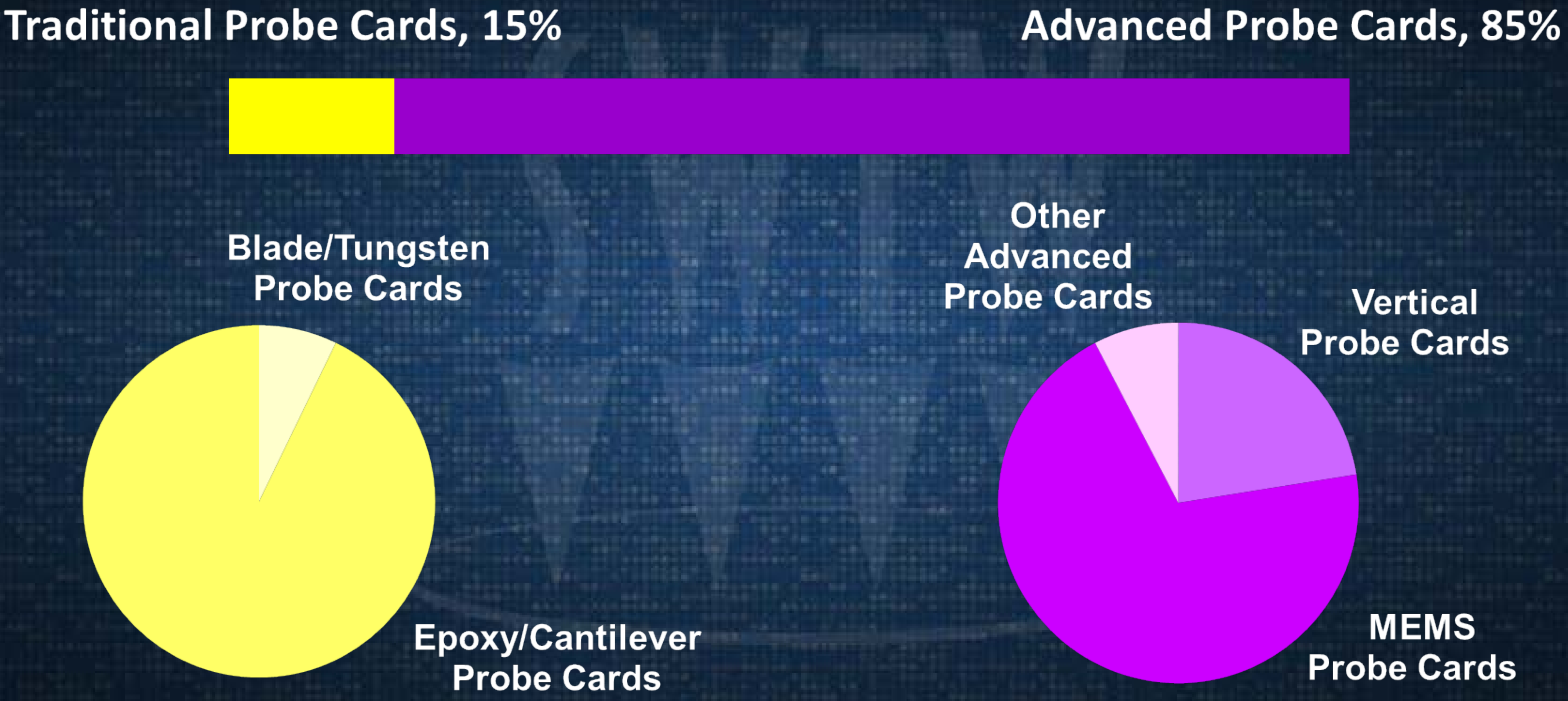
Probe Card Market Overview, $M



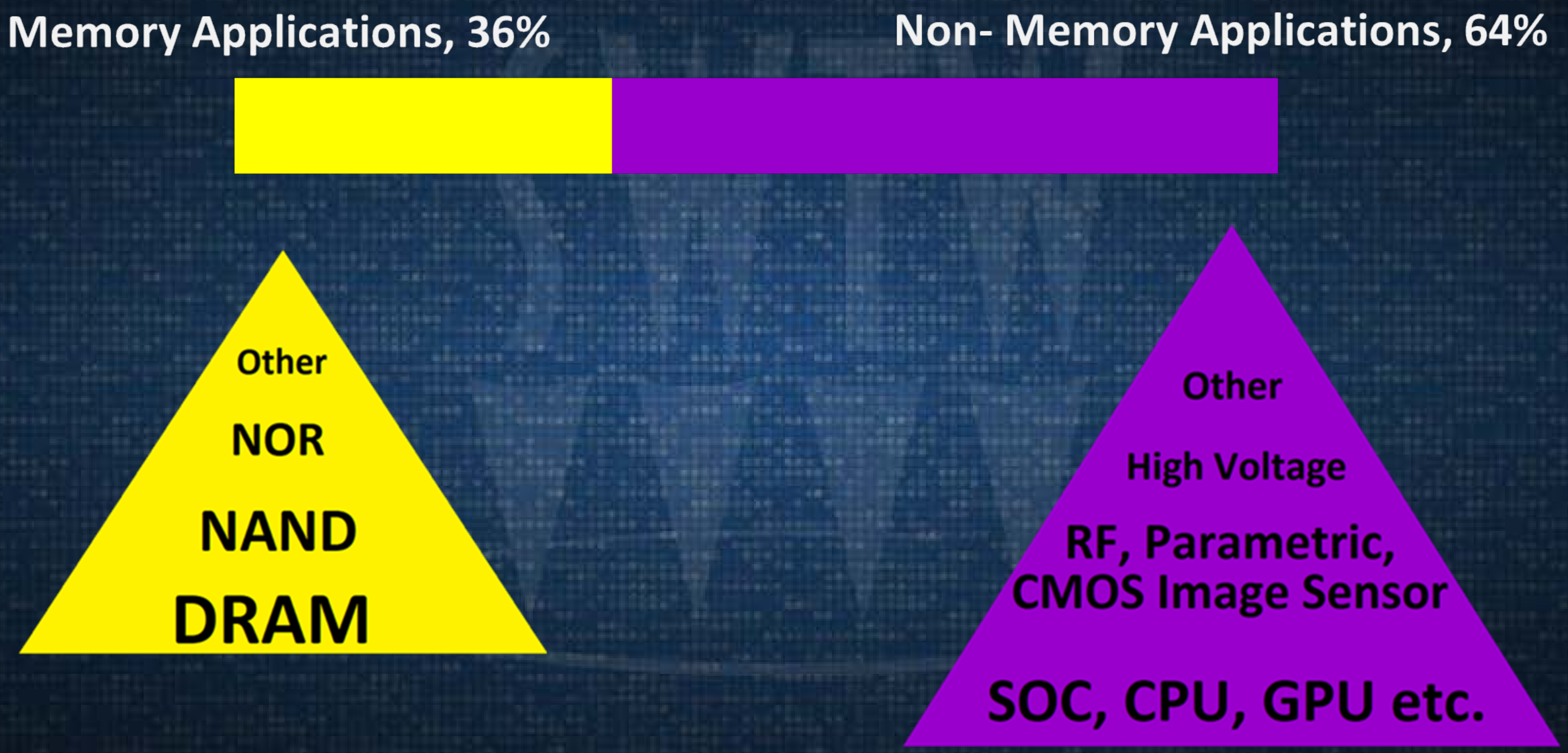
Probe Card Growth vs. Semiconductor Growth, %



2017 Probe Card Revenues by Type, $M%



2017 Probe Card Revenues by Application, $M%

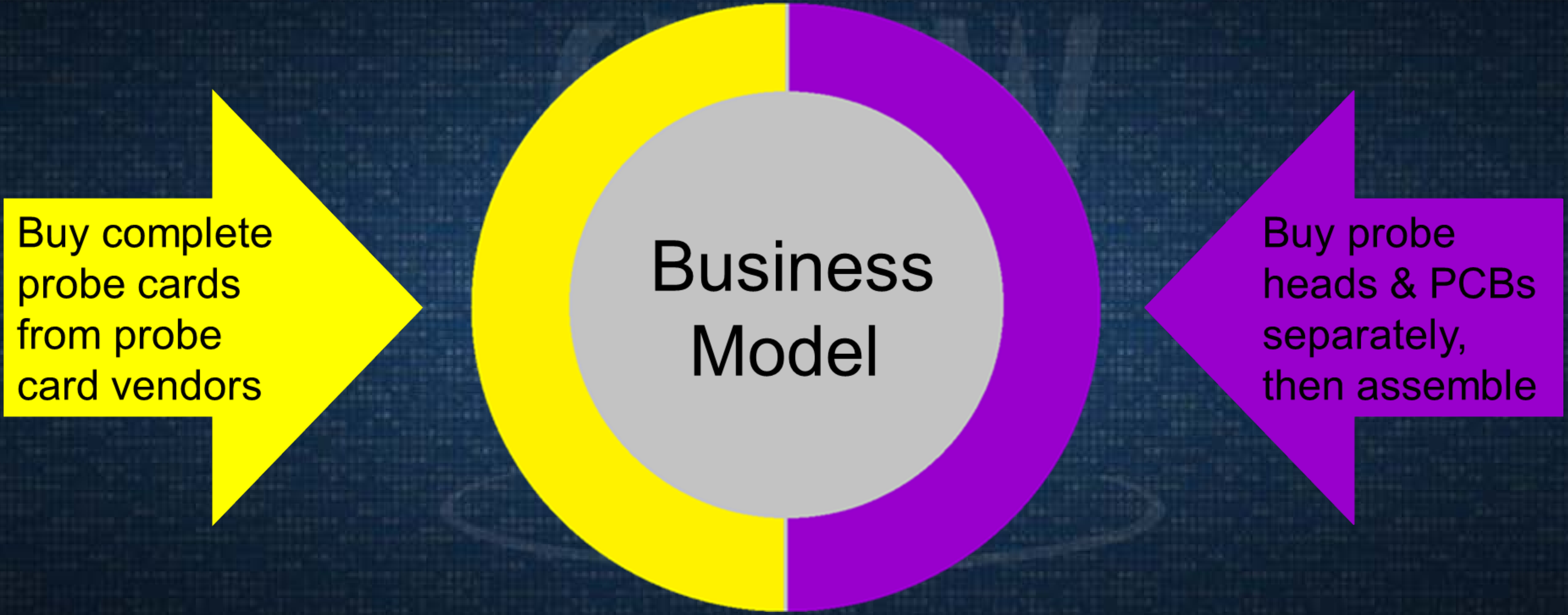


Price Trend of the Most Expensive Probe Cards, $

Capacity Managing

- In 2017, revenues of MEMS probe cards increased at the fastest rate compared to other types: well above average
- In 2017, Technoprobe built a new factory in Italy to support the increasing demand for high-end probe cards
- At the beginning of 2018, JEM decided to invest a new fab to expand their capacity in 2019

Business Model of Buyers



Regional Distribution of Main Suppliers

Main probe card suppliers' HQ located :

Europe
Japan
Korea
North America

Supply 90% ($M%) probe cards in 2017

Regional Performance of Main Suppliers

7 Main Probe Card Regions of Consumption:

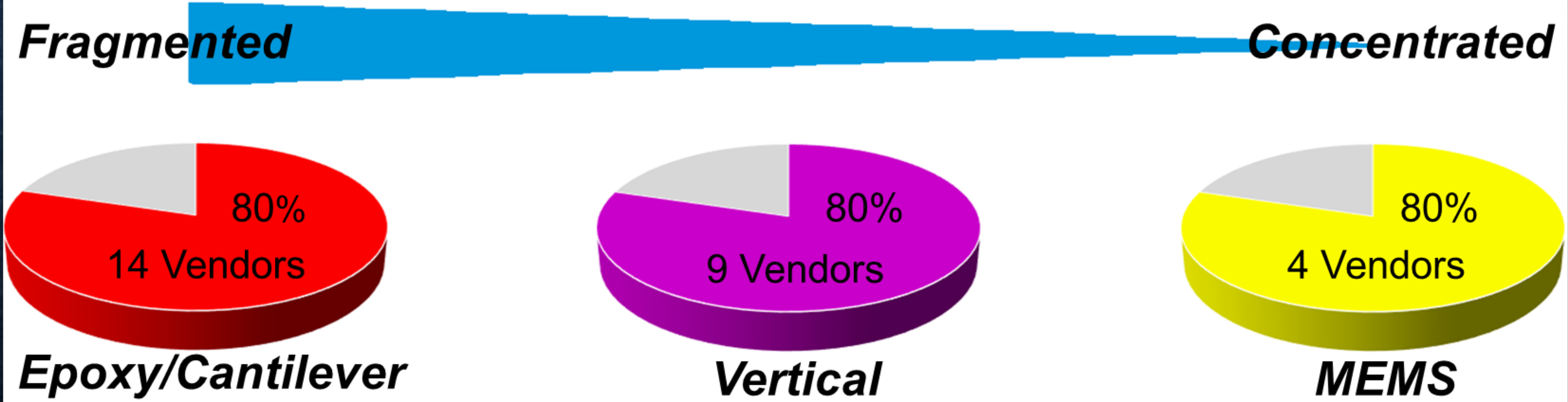
China, Europe, Japan, Korea, North America, Singapore, Taiwan

Suppliers HQ Location	*2nd Strongest area in above list (Strongest area ~ locally)*	*Weakest area in above list*
Europe	North America	China
Japan	Korea	Europe
Korea	China	Europe
North America	Taiwan	Singapore

2017 Industry Consolidation

In 2017, total probe card revenues were $1.56B

The top 10 vendors accounted for 80% market share



2017 Customer Satisfaction Survey

Surveyed Categories

Company
Trust in supplier
Support after sales
Recommend supplier
Commitment
Partnering
Field engineering support
Technical leadership
Spares support
Process support

Product
Quality of results
Usable performance
Uptime
Product performance
Overall Value

THE 2018 HIGHEST- RATED TEST CONNECTIVITY SUPPLIERS

Supplier	Rating	VLSI Stars	Highest-Rated Categories
TECHNOPROBE Wafer Probing Technologies	9.81	★★★★★	• Support After Sales • Trust in Supplier and Partnering
FORMFACTOR™	9.15	★★★★★	• Recommend Supplier • Technical Leadership
Nidec SV TCL	9.03	★★★★★	• Partnering • Commitment
Xcerra measured by your success	8.70	★★★★½	• Spares Support • Support After Sales
JEM JAPAN ELECTRONIC MATERIALS	8.12	★★★★	• Partnering • Recommend Supplier

Source: VLSIresearch
Doc: css_testconnectivity_v18.05

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- Semiconductor sales slowing in 2018 but it is still expected to be another great year with sales growth of 12.5%
- As new memory capacity comes on line, rapidly falling memory prices are likely to result in an overall semiconductor sales decline (-3%) in 2019
- Sales of Analog and Logic chips to grow 8% in 2018 and 2.5% in 2019
- Driven by the semiconductor market, sales of probe cards are expected to be increase by 7.3% in 2018