



# Probe Card Market Dynamics in a Turbulent World



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# Overview

- **These are turbulent times!**
- **Probe card market dynamics in a fast-changing environment**
- **Navigating the way through the next few quarters**

# Semiconductor Super Cycle

## Long-term market drivers still intact

### It's a data centric world:

Data collection, processing,  
and storage = monetisation

Electrification

Connectivity

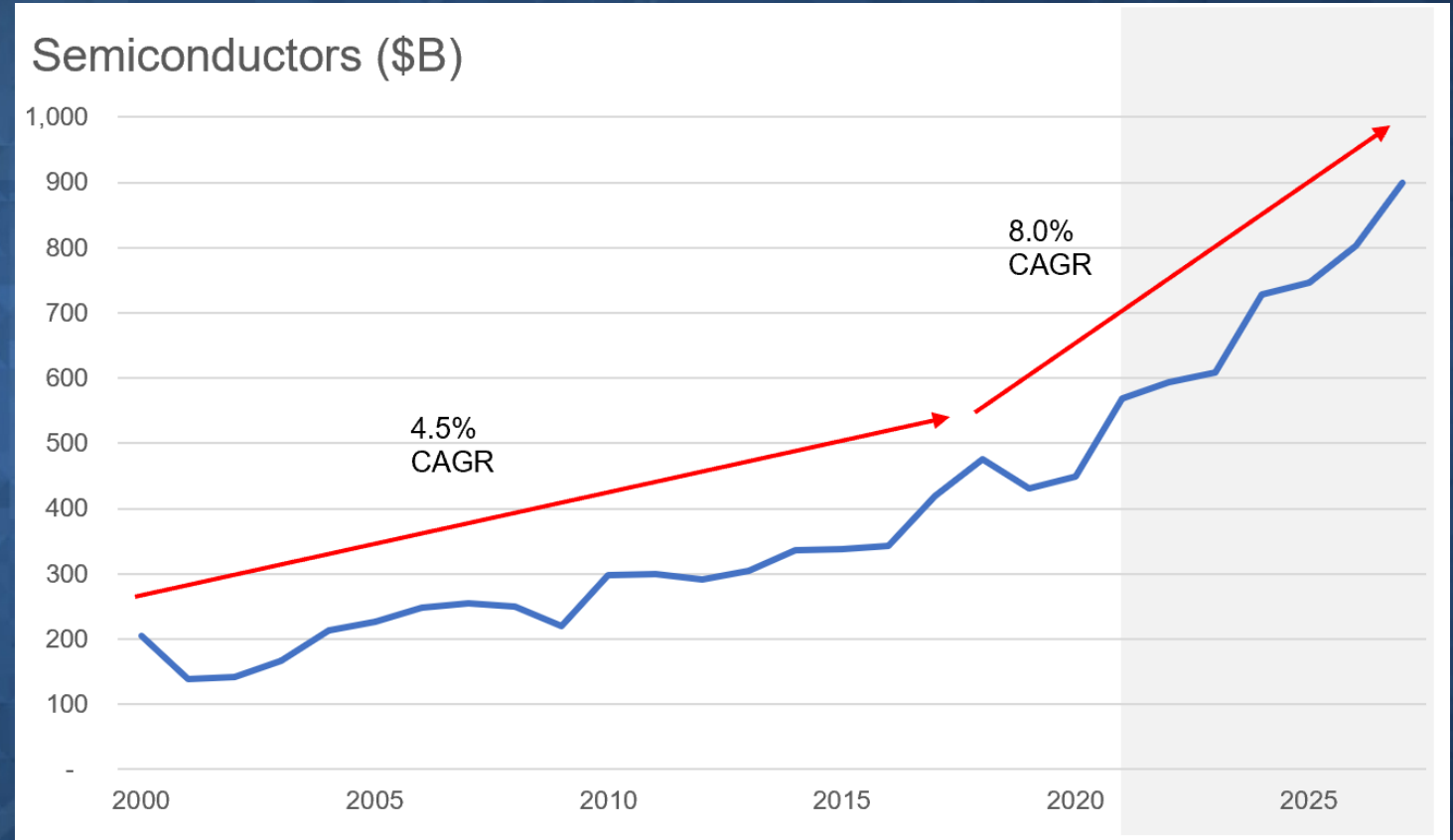
Clear technology roadmap to 1nm

### Semiconductor Outlook:

2022 – growth between 5% and 10%

2023 – flat, but uncertain

2024 – recovery





# 2023 is going to be tricky

## Multiple factors in play

- **Decoupling of high-tech trade between US and China**
  - Supply chain disruptions
  - Higher costs
- **Cost of living crisis**
  - Higher energy costs
  - Higher interest rates
  - Inflation
- **Strong US Dollar**

# Memory

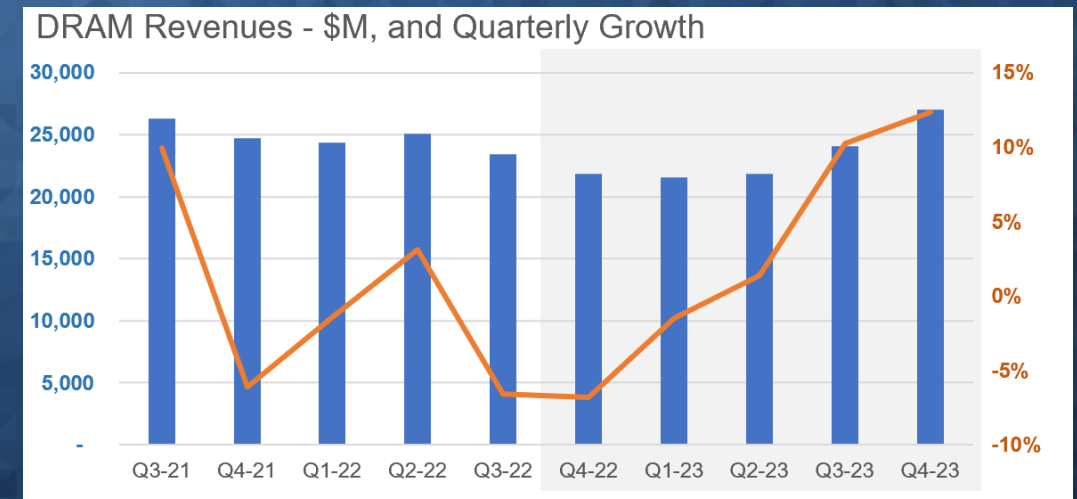
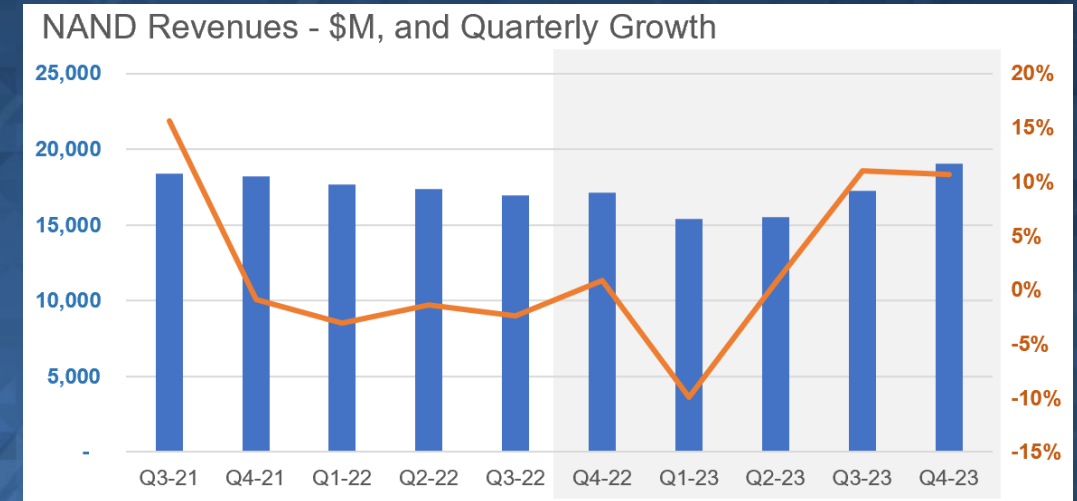
## Recovery underway from Q2 2023 onwards

### NAND:

- Volatile unit shipment demand Q/Q
- Very weak pricing environment until 2H 2023
- 18% CapEx reduction in 2023
- Annual growth: 2022 = -3%  
2023 = +3%  
2024 = +20%

### DRAM:

- Unit shipments growing low single digit rates Q/Q
- Weak pricing and inventory corrections
- 25% CapEx reduction in 2023
- Annual growth: 2022 = +0.5%  
2023 = -0.3%  
2024 = +43.8%



# Non-Memory

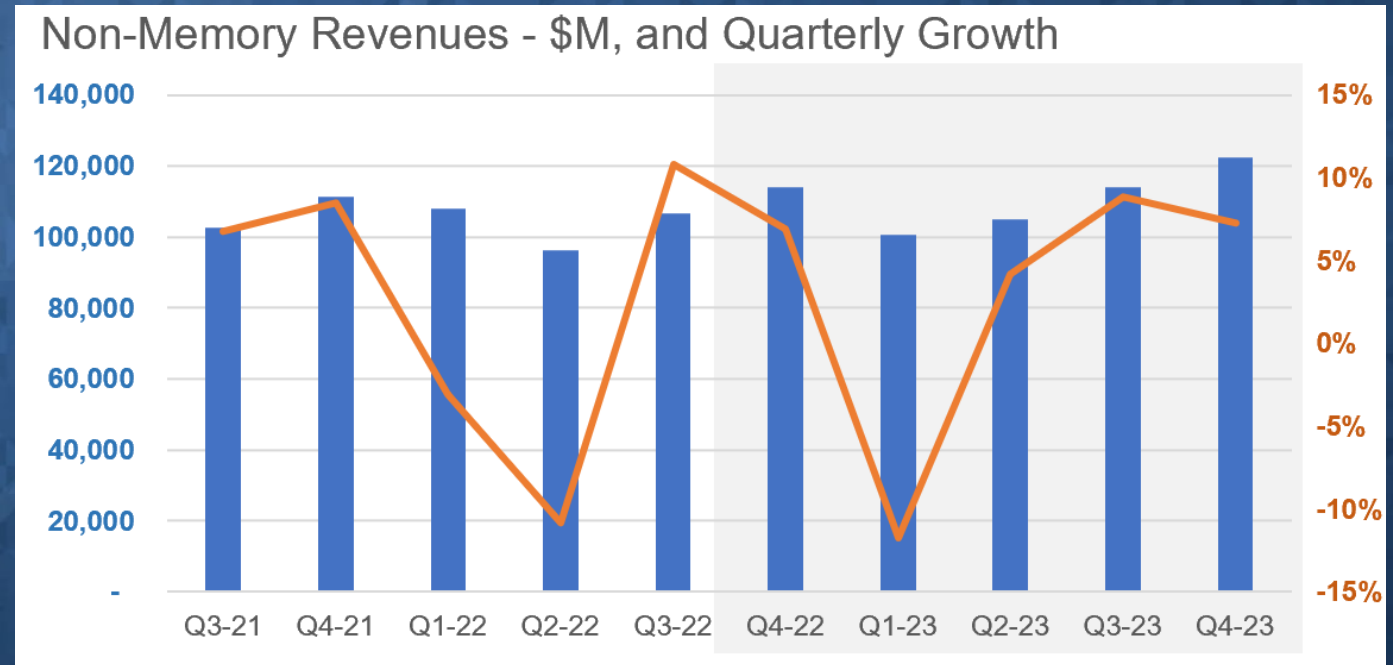
Uncertain times ahead, but recovery from 2H 2023 onwards

## Negatives:

- Macro-economic headwinds putting pressure on consumer electronics
- US export controls

## Positives:

- RF Chips
- Power ICs
- Image Sensors
- Advanced Packaging
- Increased number of chip designs

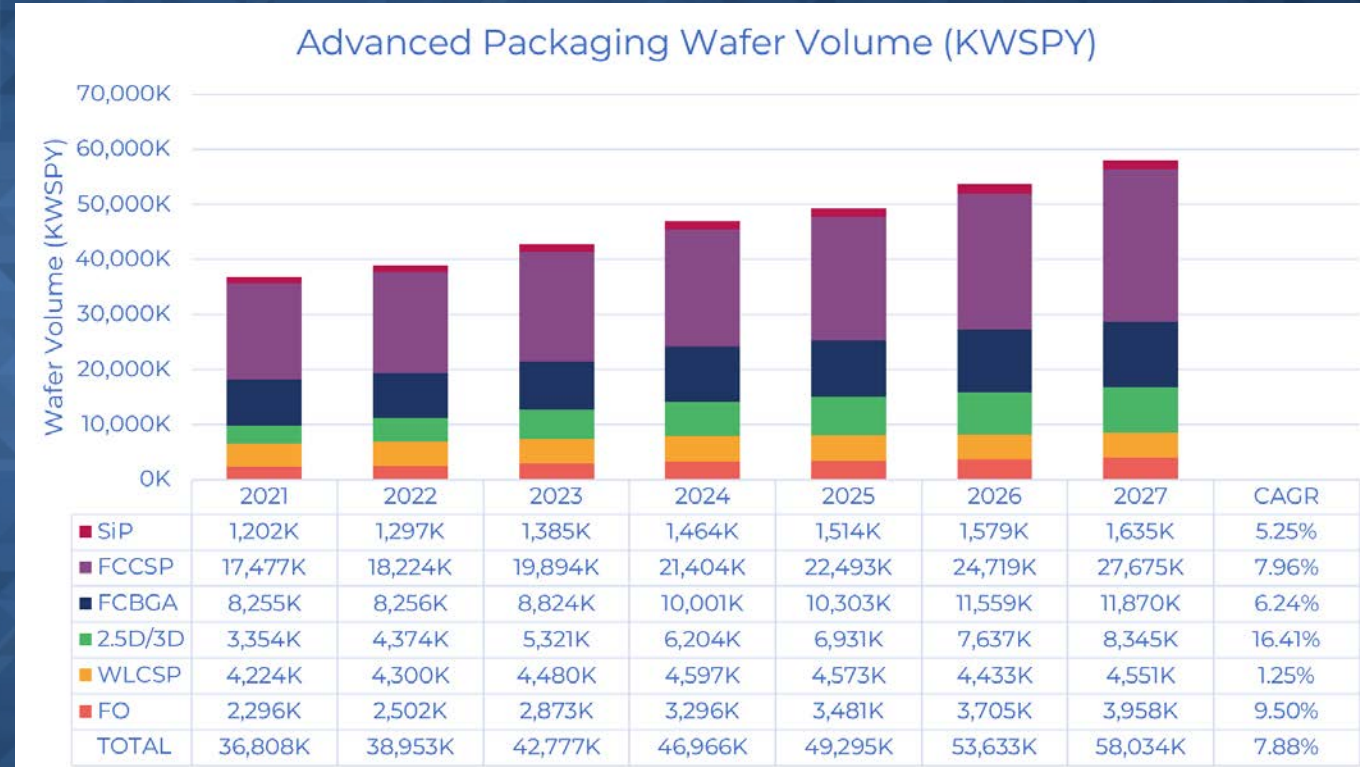




# Advanced Packaging

## 2.5D/3D and FO leading growth

- **Wafers for advanced packaging a strong driver for probe card growth**
  - Longer test times
  - Lower yields
- **2.5D/3D and FO small but growing fast**



# Probe Card Revenues

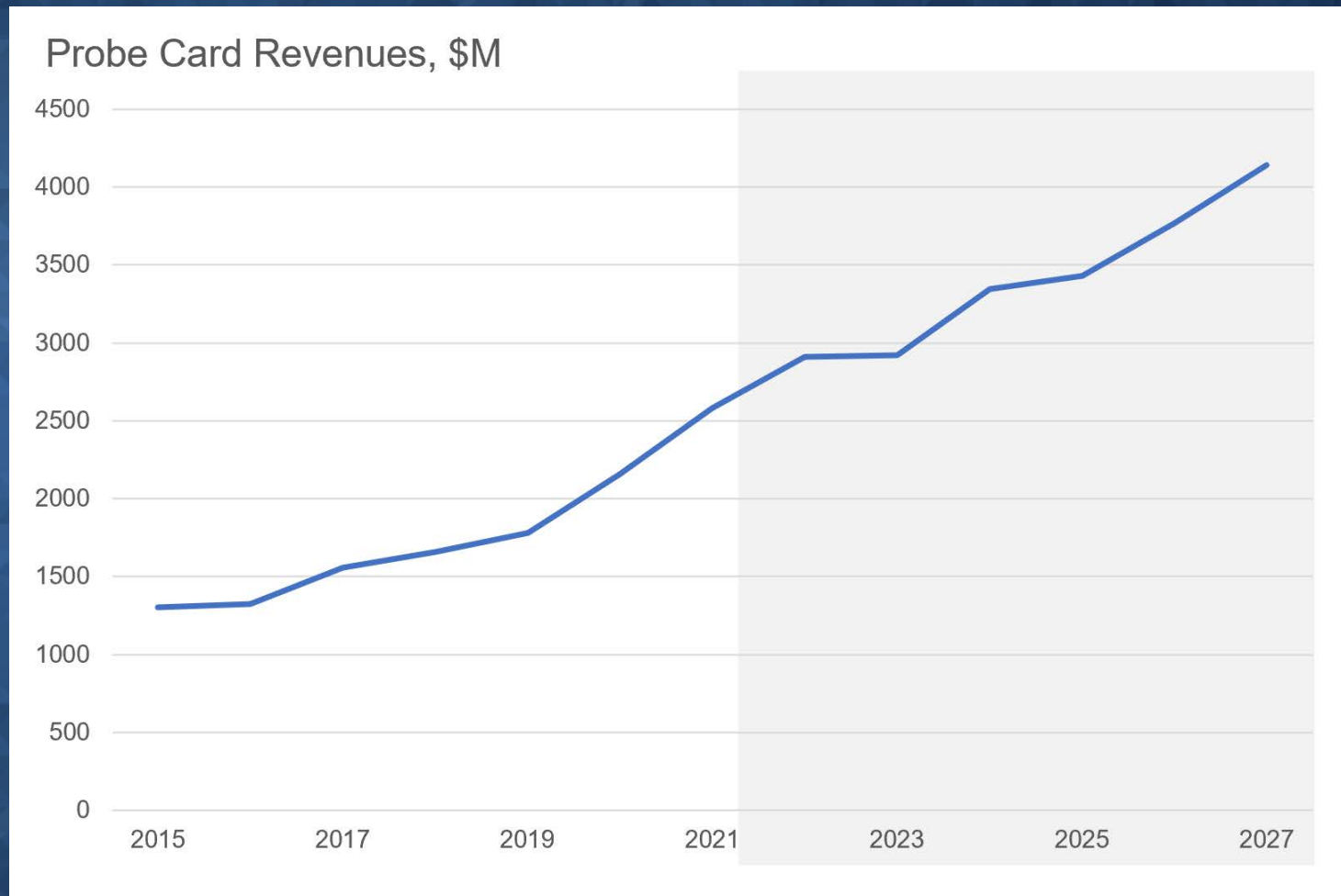
**Overall outlook is positive**

Market will be very choppy over next several quarters

Supply chain reconfiguration  
Inventory corrections  
Changing customer mix  
Net sum zero in 2023

## Probe Card Market Outlook:

2022 – growth between 10% and 15%  
2023 – flat, but volatile for some (\$3Bn)  
2024 – recovery  
2027 - > \$4Bn





# Probe Cards vs. Semiconductors

## Chipmakers spending more on probe cards

Step change in 2020

Was this COVID related or something else?

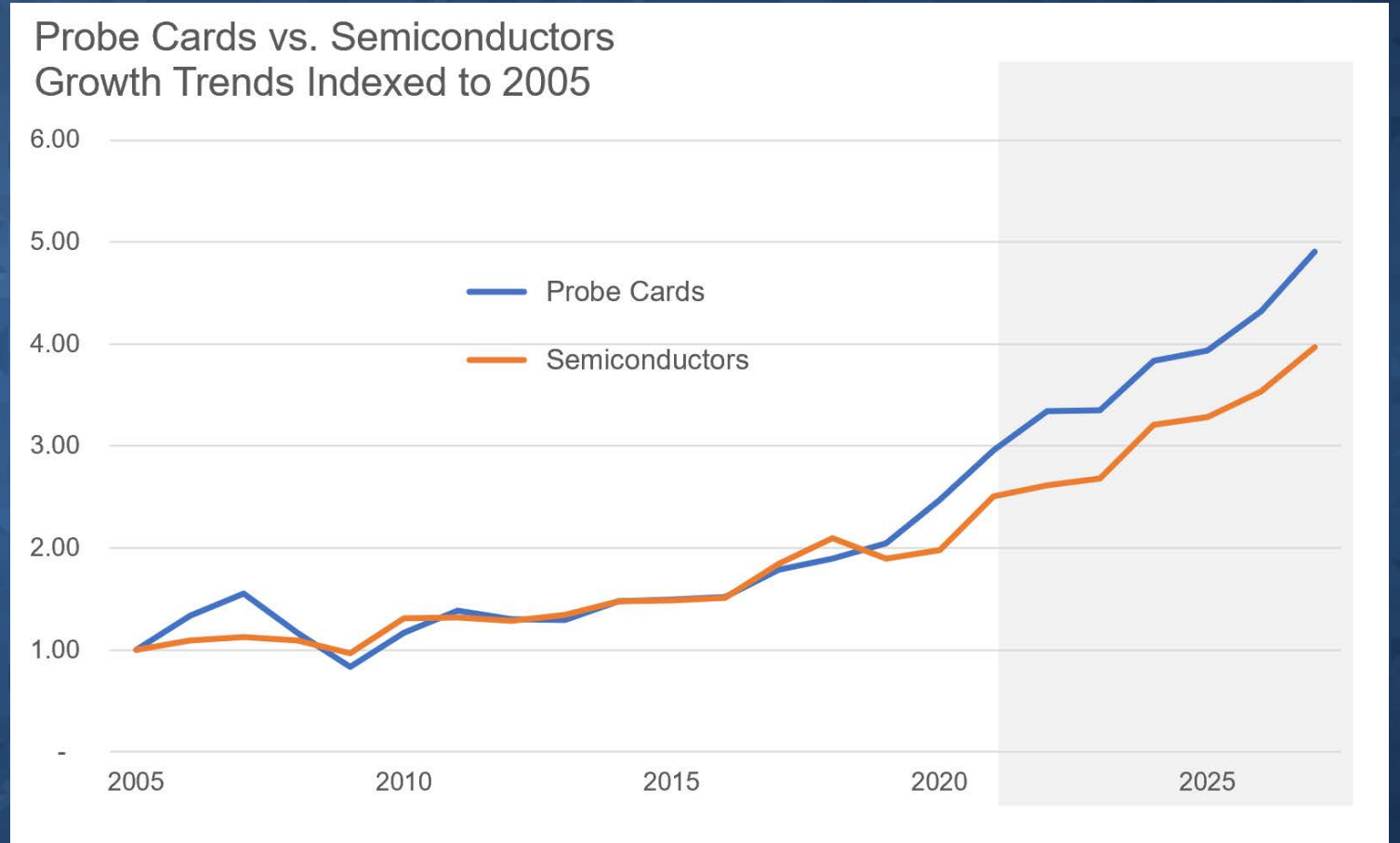
Chipmakers raised test capex intensity after a long period of decline

Test challenges are on the increase

Increase in wafer level burn-in

Increase in # of chip designs/re-designs

Sustained increase in spending from 2020 to 2022 – is this now a trend?



# Probe Cards vs. Semiconductors

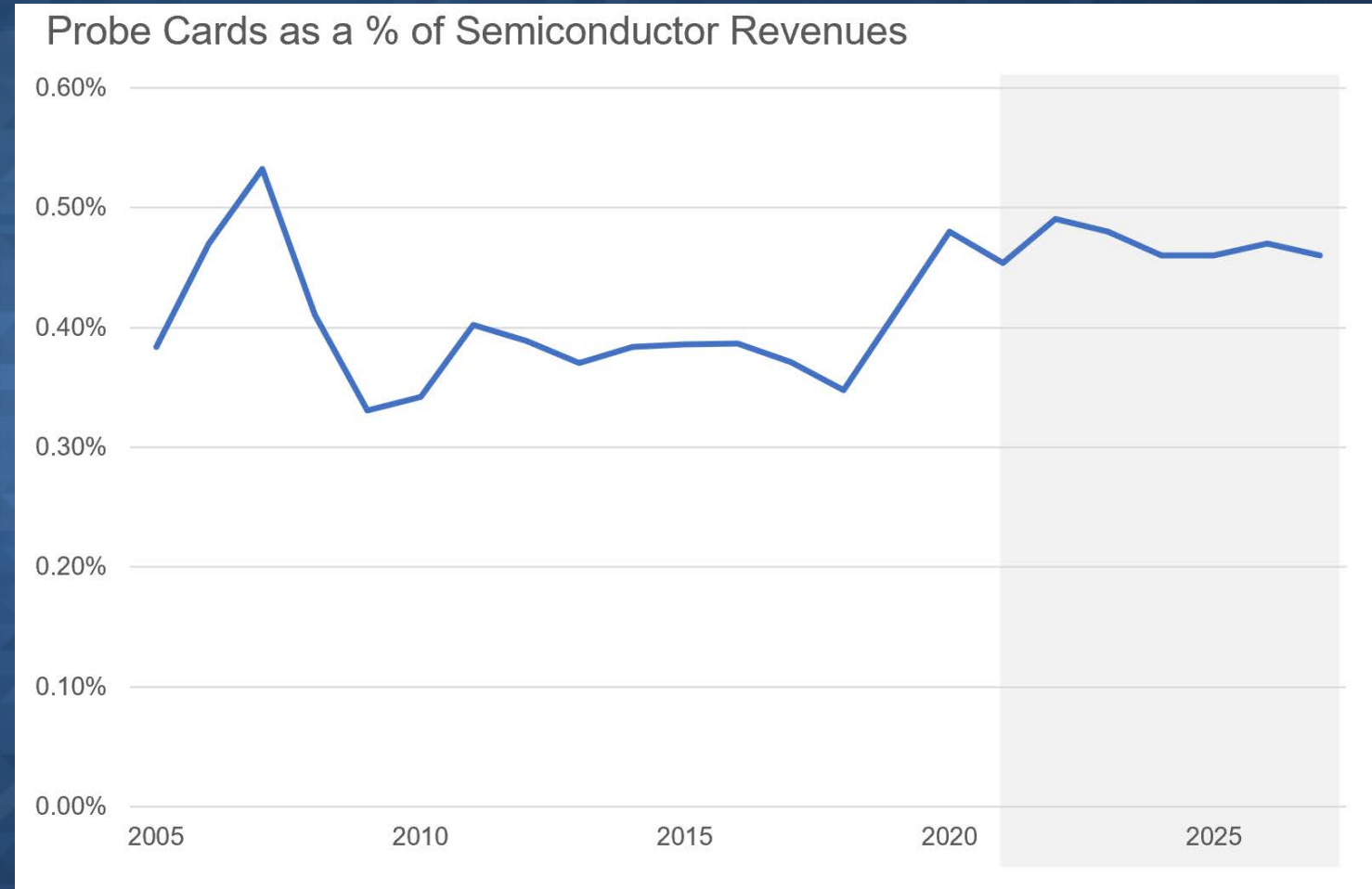
## Chipmakers spending more on probe cards

**Spend as a % of Semiconductor Revenues Jumped up from an average of 0.38% to 0.48% in 2020**

**However, this is only the value of the probe card market from the probe card suppliers' perspective**

**Does not include the value of probe card PCBs and space transformers purchased directly by chipmakers**

**Accounting for “all” expenditure on probe cards means the industry is spending in excess of 0.55% of revenues on probe cards**



# 2023 is going to be tricky

## Winners and losers by device type

- **Winners**

- RF
- Power IC
- Image Sensors
- Die for use in 2.5D/3D and FO advanced packages

- **Losers**

- Memory
- Graphics Chips ???
- Microprocessors



# Market is fluid and fast-changing

**But some things are clear...**

- **Western countries' policies are set for the long-term**
  - Short to medium-term disruption
- **Fundamental market drivers are intact**
  - Long-term growth is assured
- **Technology road map is clear for next 5 to 7 years**
  - No show stoppers

# Summary

## Change is good...

- Short-term market turmoil will drive change in the competitive landscape
- Chipmakers are under pressure to find solutions so are more open to working with smaller suppliers
- Test strategies are constantly evolving
- This is a great time to be a probe card supplier!

# Thanks

- **Get to up-to-date market research**
- **Be pro-active**
- **Think big, act smart**