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Test and Burn-in Socket Market Update

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BiTS Workshop
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VLSIresearch

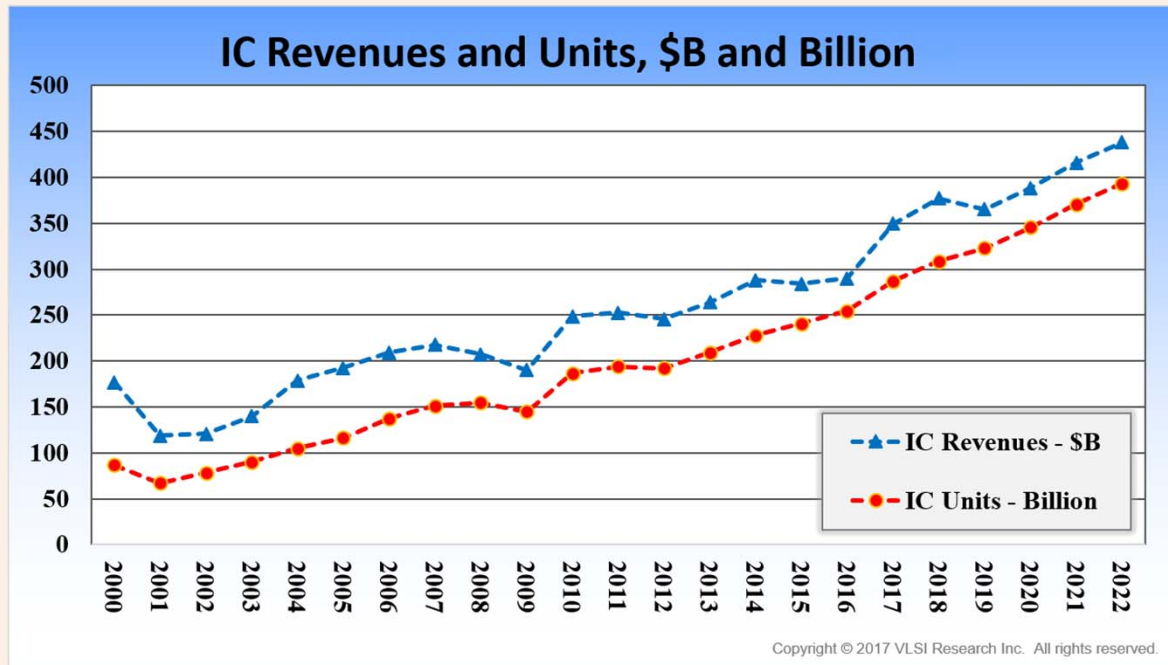
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- **Global IC Market**
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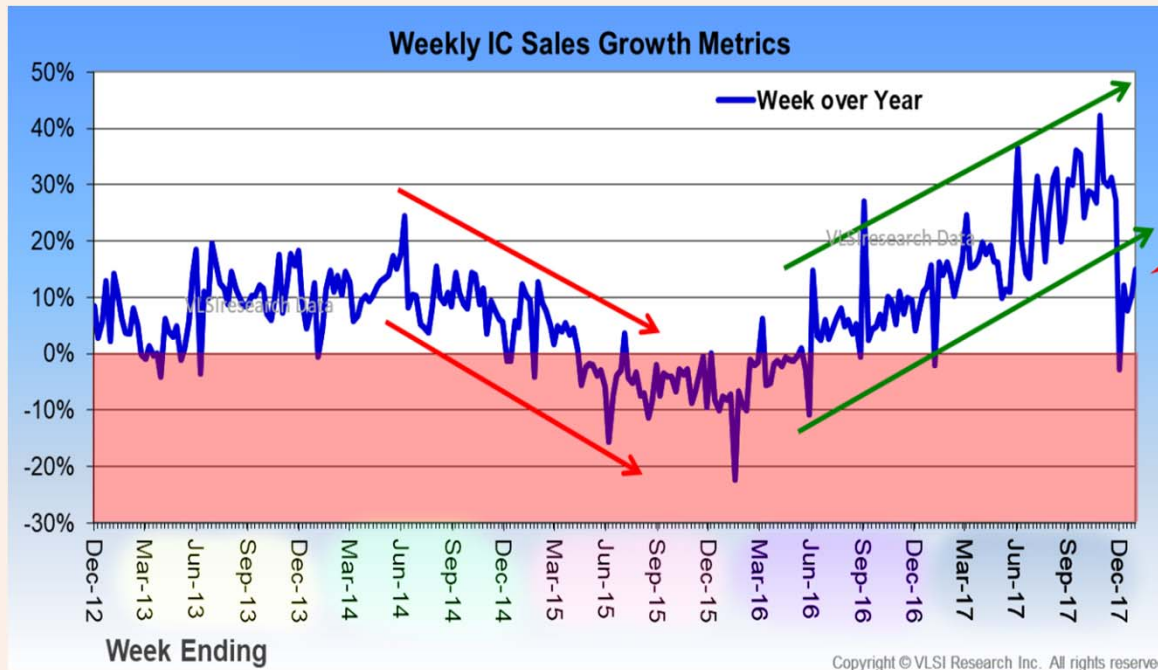
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IC Revenues and Units



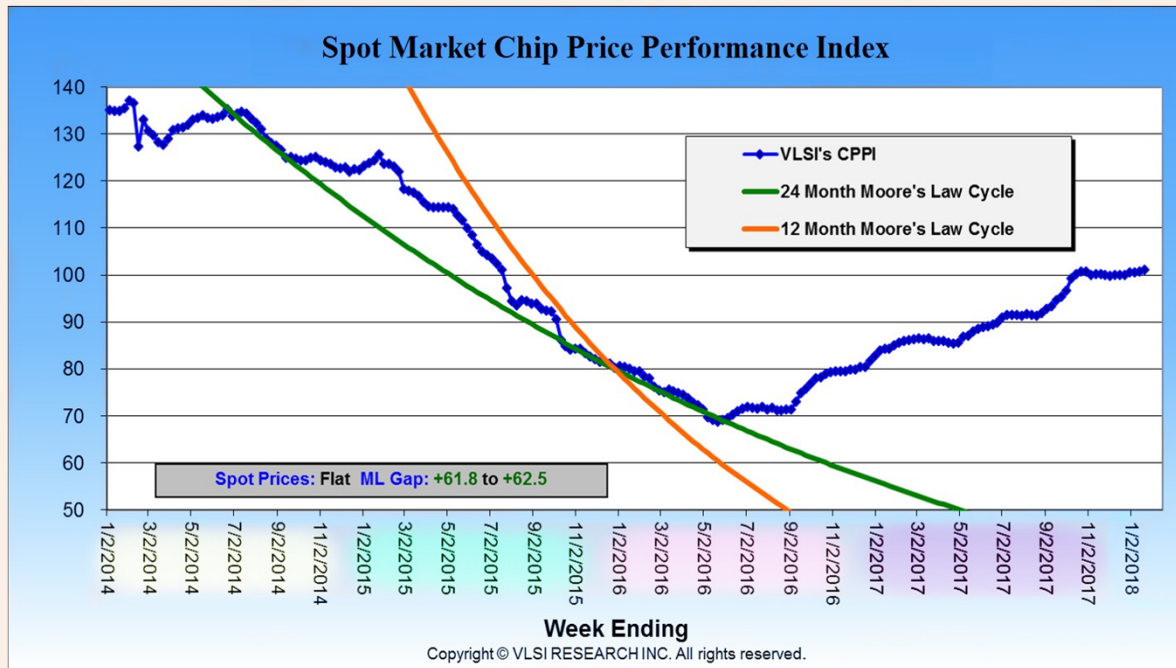
- Clearly, the IC market is on a continuous growth trend
- Y17 - Y22 CAGR : 4.6%
- Y18 annual growth : 7.8%

Week-Over-Year IC Sales Growth Trends



- Current upturn from beginning of Y16
- Peak w/w growth : 40%
- Always a correction at the end of Year
- Latest trend is on a growth path

Spot Market Chip Price Performance Index



- Strong pricing in Y17
- Trend continues in Y18
- Main price drivers in Y17
 - DRAM up **73%**
 - Flash up **28%**

IC Demand – Supply Balance

| Pivot Points → Week ↓ | Overall | DRAM | NAND/NVM | IDM | Foundry/Fabless |
|--------------------------|---------------------------------------|--|---|-----------------------------|---------------------------|
| | Capex has yet to ease memory shortage | Constrained CapEx created long-term shortage | Supply expanding into fixed demand growth | Cloud, IoT and Power strong | Mobile soft, 7nm pushouts |
| 3Q 2016 | Shortage | Shortage | Shortage | Shortage | Shortage |
| 4Q 2016 | Shortage | Shortage | Shortage | Shortage | Shortage |
| 1Q 2017 | Shortage | Shortage | Shortage | Shortage | Shortage |
| 2Q 2017 | Shortage | Balanced | Shortage | Shortage | Tight |
| 3Q 2017 | Shortage | Shortage | Shortage | Shortage | Balanced |
| 4Q 2017 | Shortage | Shortage | Shortage | Shortage | Balanced |
| 1Q 2018 NowCast | Balanced | Shortage | Balanced | Balanced | Saturated |
| 2Q 2018 Forecast | Balanced | Shortage | Shortage | Tight | Loose |

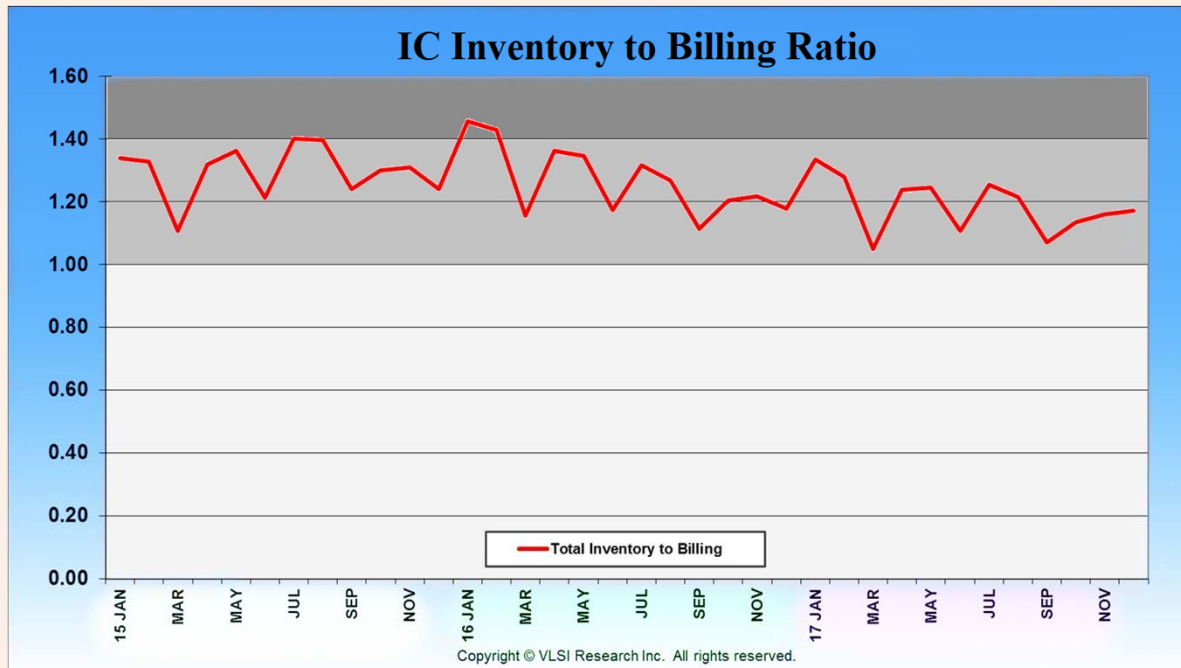
Range: Shortage-Tight-Balanced-Loose-Saturated-Glut

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IC demand – supply in Y17 : **Shortage**

IC demand – supply in Y18 : **Balanced**

IC Inventory to Billing Ratio

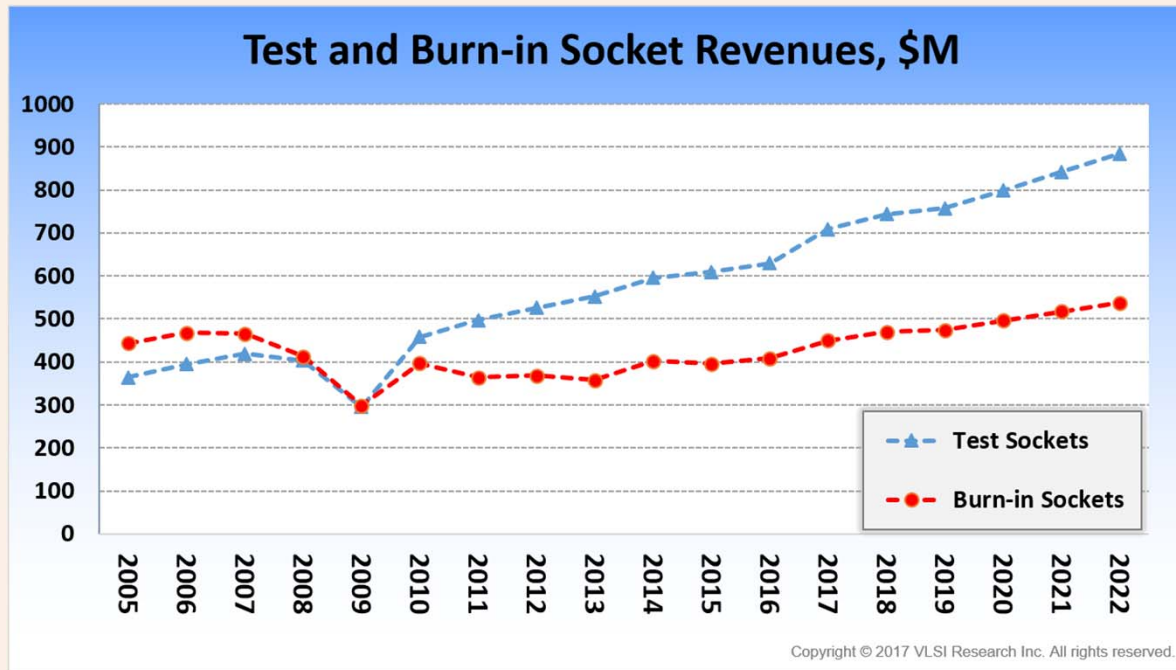


- Normal inventory to billing ratio : 1 ~ 1.4
- At the end of Y17, the inventories were at a healthy (1.2 months)

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Test and Burn-in Sockets

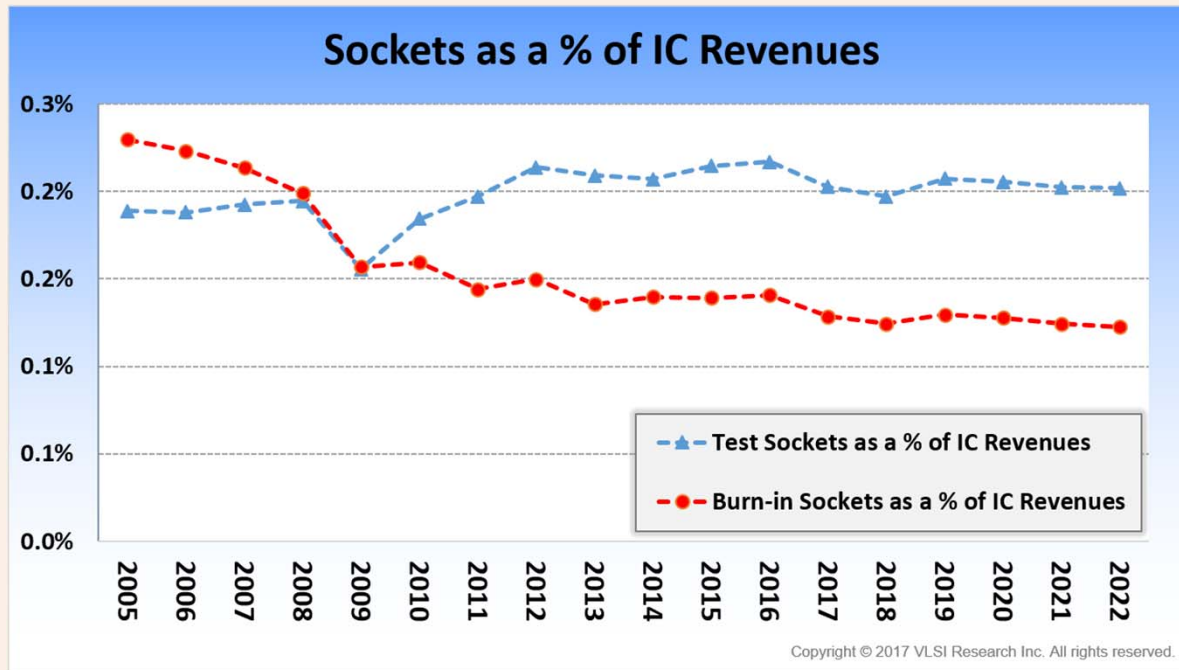


- Test socket market:
larger & growing faster
- Test socket CAGR:
4.5% (Y17 - Y22)
- Burn-in socket CAGR:
3.6% (Y17 - Y22)

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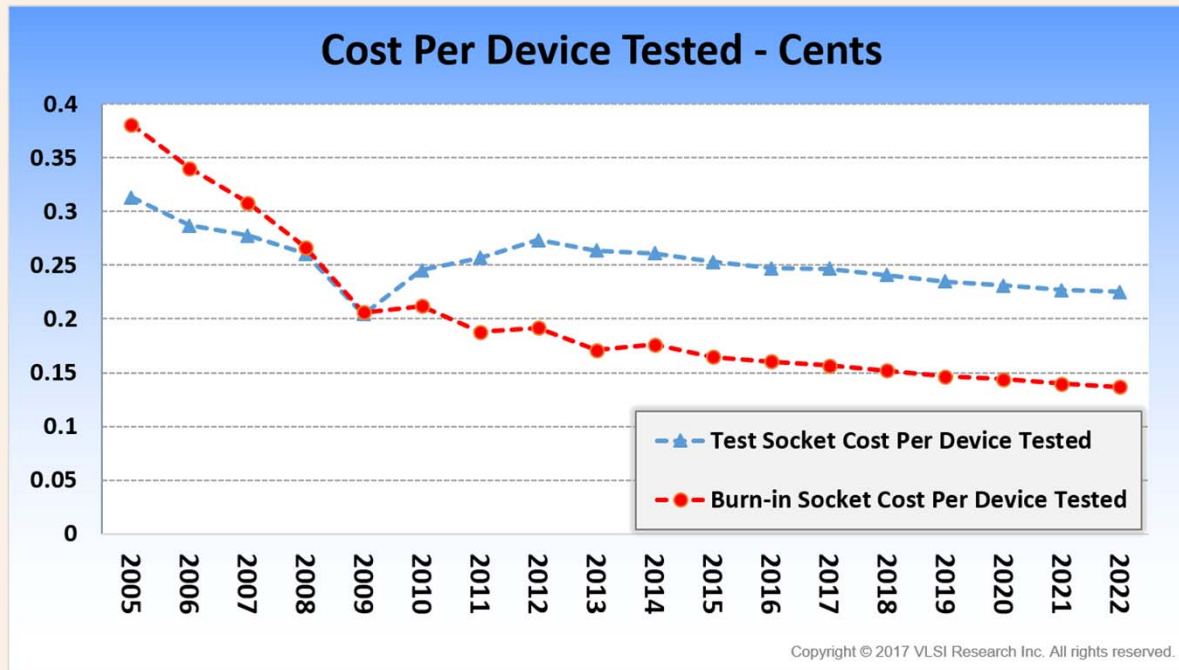
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Cost of Test



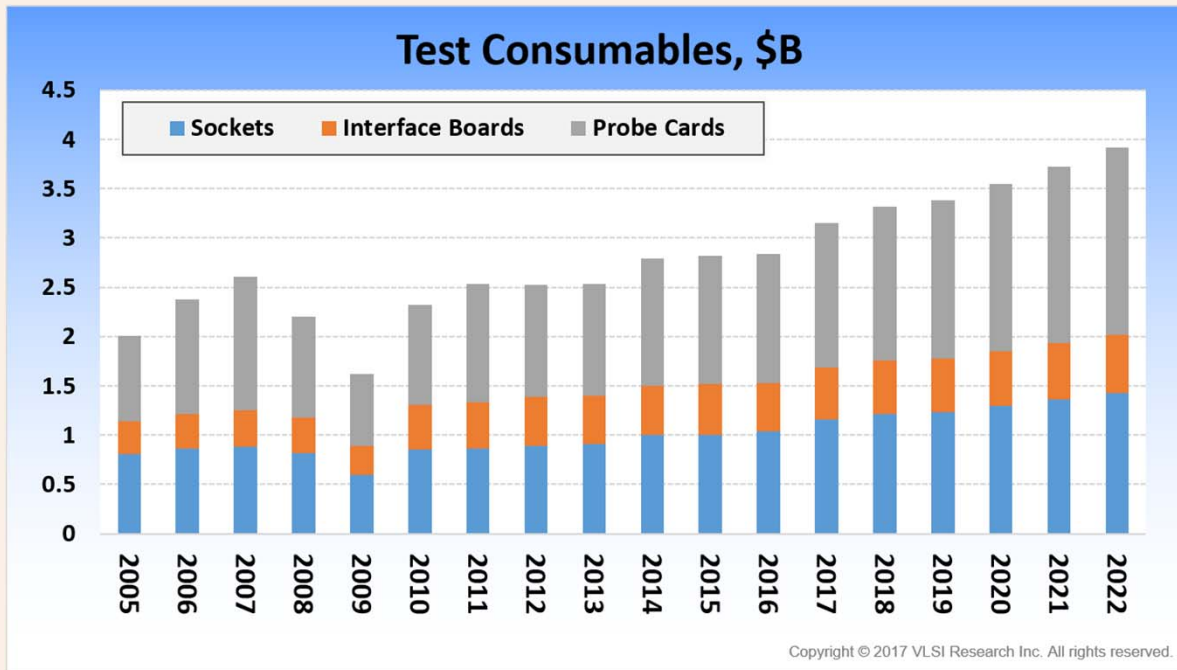
- Sockets as a % of IC revenues trending **flat**
- Historically, the trend has been **downwards**
- The challenge is to get back on a downwards path

Cost Per Device Tested



- Cost per device tested not falling down enough
- Cost of leading edge applications are going up

Test Consumables

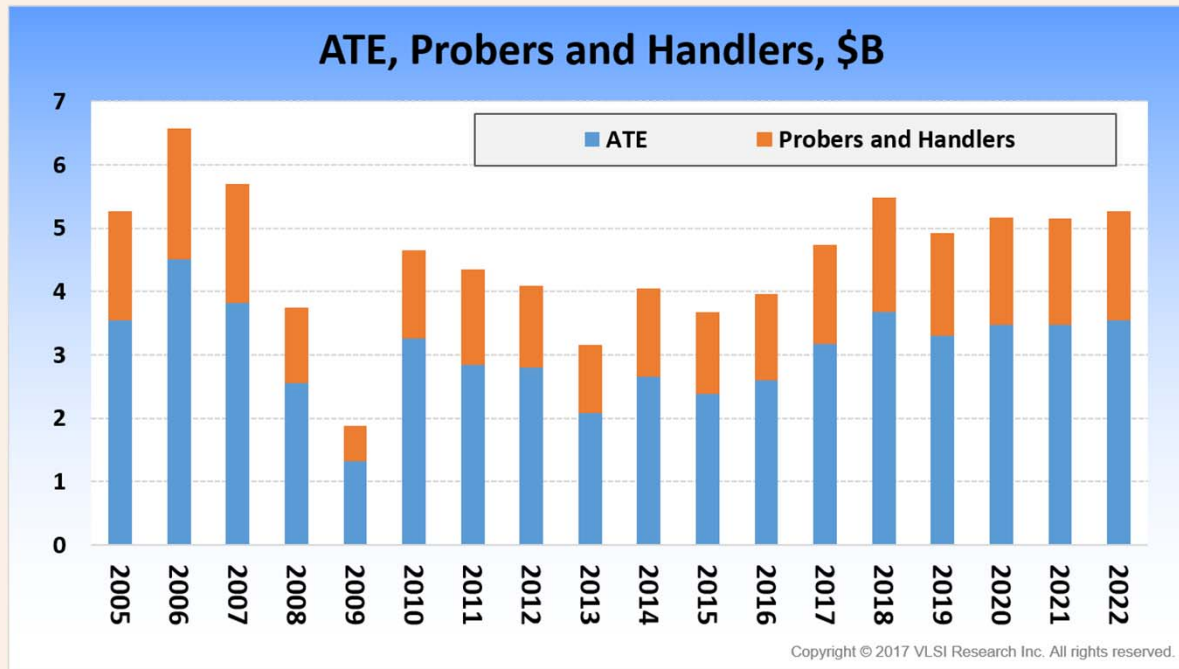


- Expenditure of test consumables :

 > \$3B in Y17 with

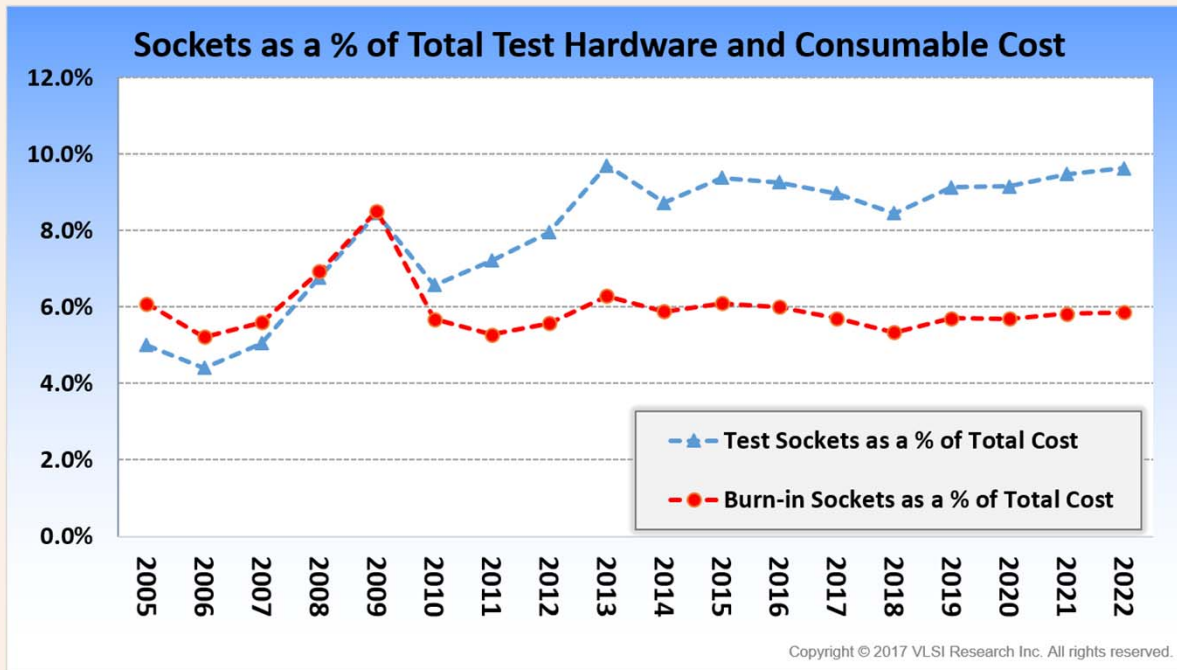
 growth of 11%
- Y17 - Y22 CAGR : 4.5%

Test Equipment



- Expenditure on test equipment trending **down** from Y06 to Y15
- Expenditure > **\$4.5B** in Y17 with trending **flat** from Y18 to Y22

Sockets as a % of Total Cost



- Socket cost (Y17 to Y22):

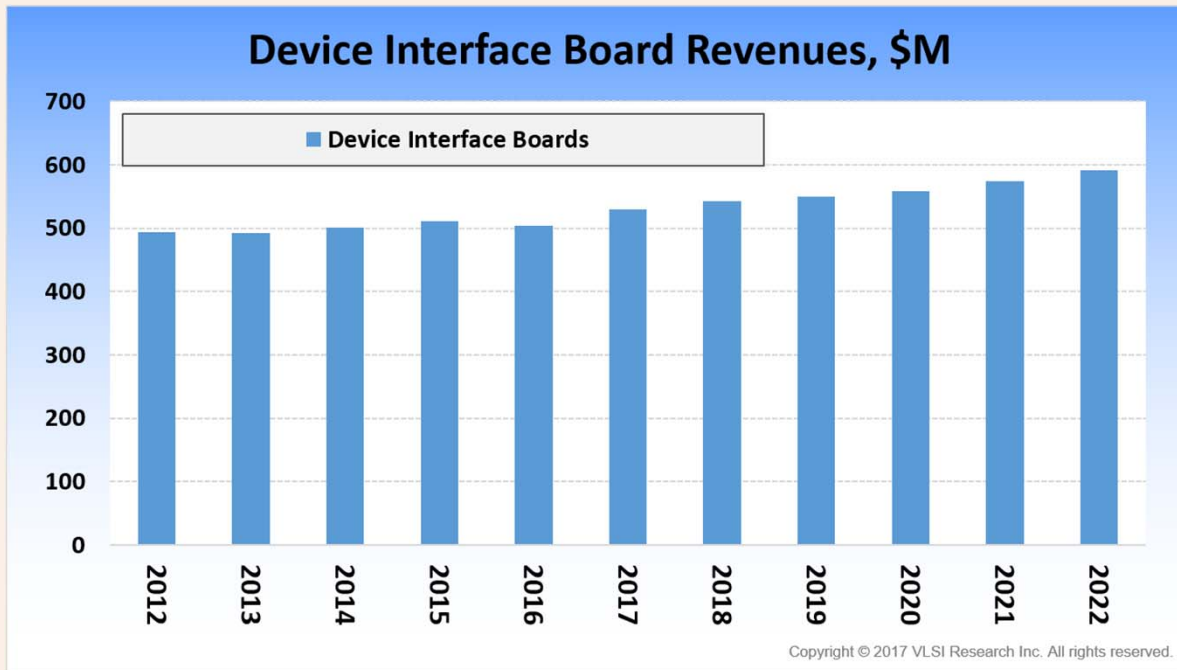
8% to 10% - Test sockets

5% to 6% - Burn-in sockets

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Device Interface Boards



Top DIB Vendors

| |
|--------------------|
| R&D Altanova |
| Harbor Electronics |
| TSE |

- Market size: > \$500M

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Customer Satisfaction Survey



- Orange: related to company
- Green: related to product
- Average Rating: **8.47**
- Compares to an average rating of **8.53** for equipment

Conclusion

- Y17 - Y22 CAGR:
 - 4.6% for ICs
 - 4.5% for test sockets
 - 3.6% for burn-in sockets
- Y18 is expected to be a strong year
- Y19 could be a correction year with flat or downward trend