



ChinaTM

Virtual Event

November 1 – 4, 2022
Virtual Event

www.testconx.org

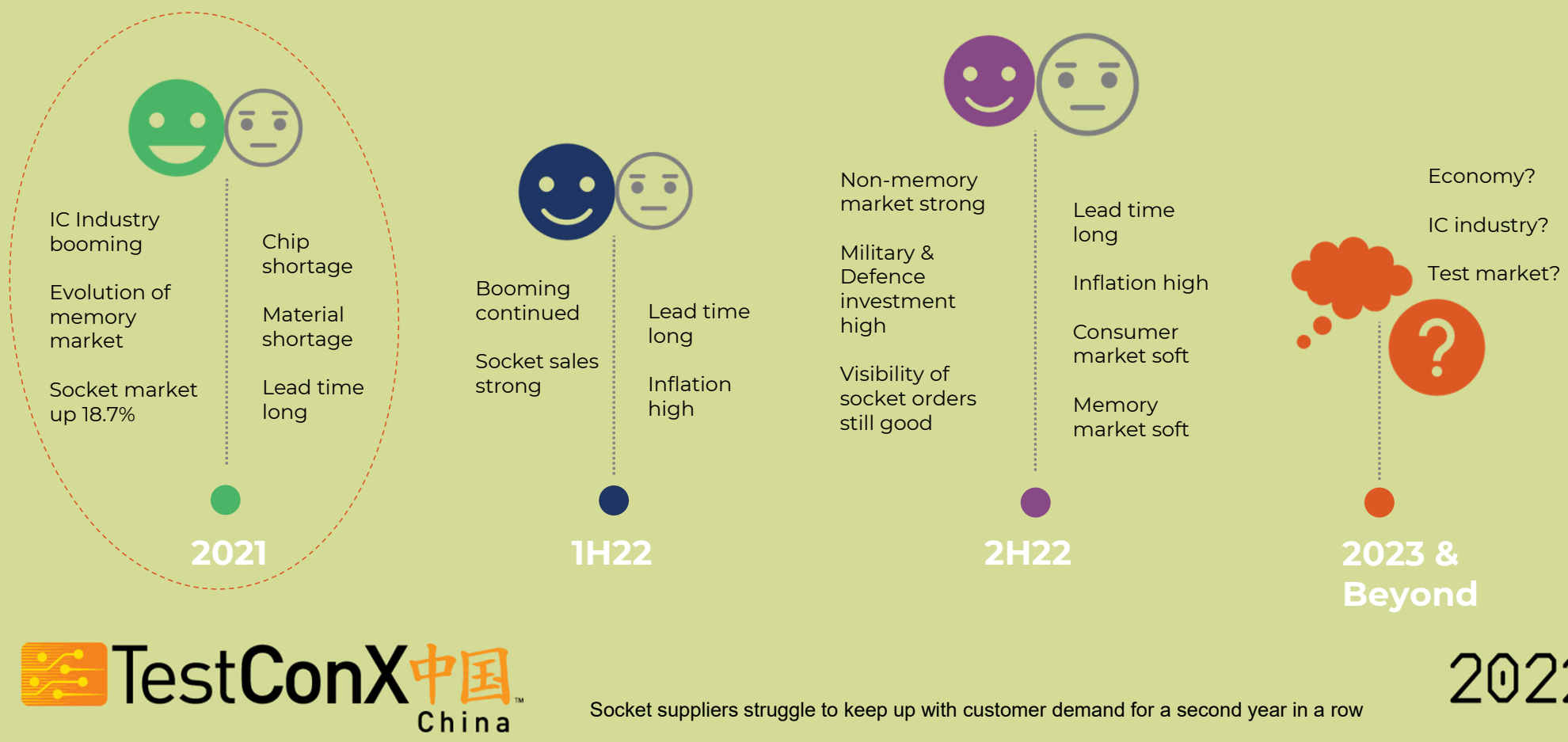
Socket suppliers struggle to keep up with customer demand for a second year in a row

Lost opportunities and new opportunities in a fast-changing environment

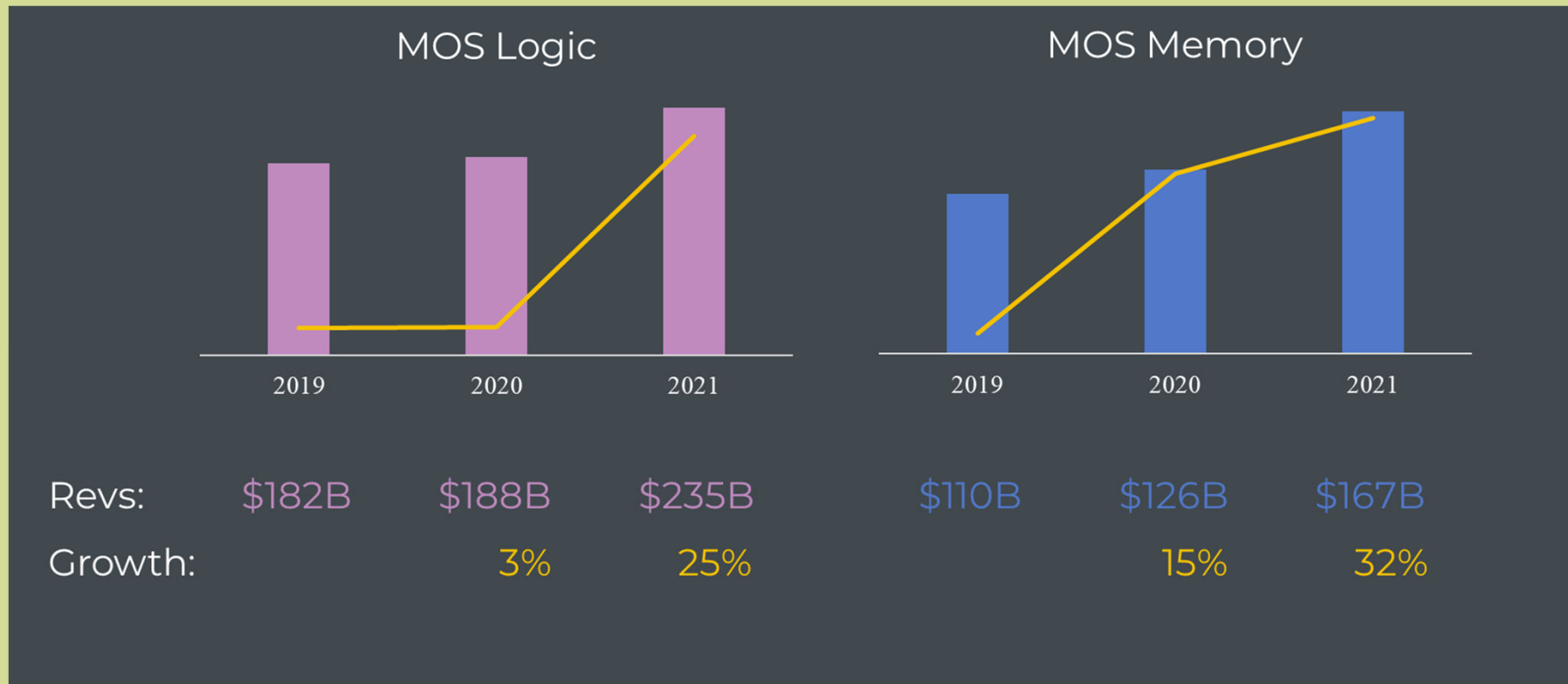
Lin Fu
YOLE Group



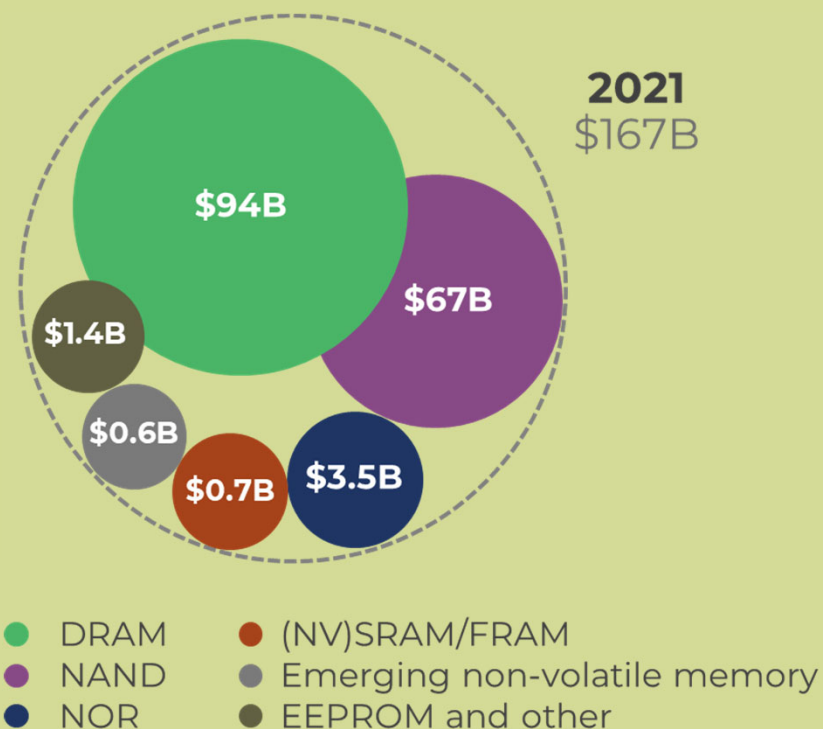
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2021 IC Industry Booming



2021 Evolution of the Stand-alone Memory Market



Source: Status of the Memory Industry 2022, May 2022



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2021 – A very strong year for memory

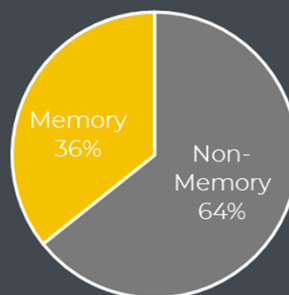
- The anticipated post-COVID global economic recovery drove strong demand for memory
- Work-from-home continued to be a story in 2021, led to continued strength in the PC market
- Consumers returned to the phone market after a weak 2020
- Data center demand was very strong

2021 Socket Market Highlights

2021 BURN-IN SOCKET HIGHLIGHTS

PERFORMANCE

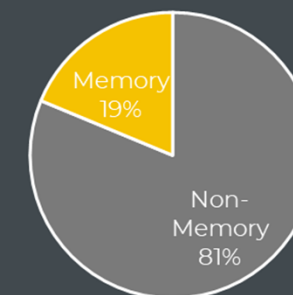
ASP: \$10.3
Revenue: \$487M
Shipment: 47M



2021 TEST SOCKET HIGHLIGHTS

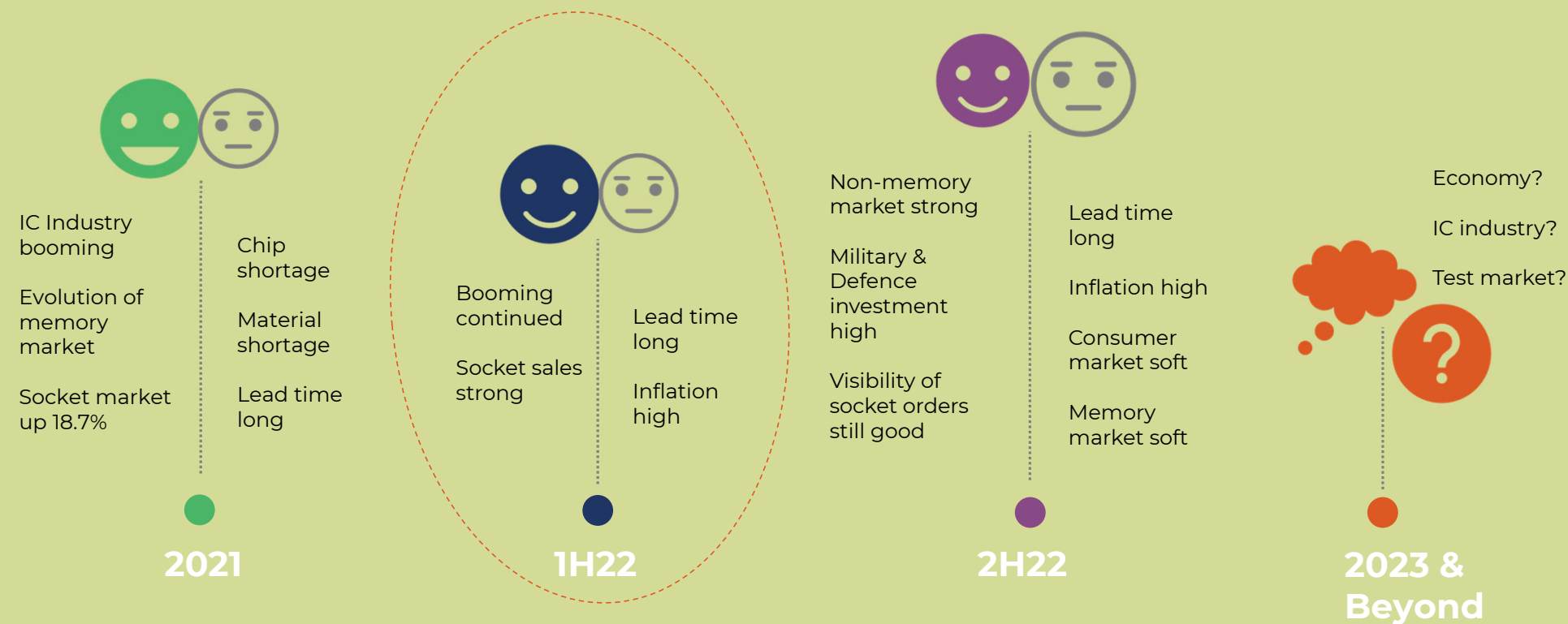
PERFORMANCE

ASP: \$1280
Revenue: \$1240M
Shipment: 0.97M



- Revenue grew 18.7% in 2021, but would have been greater if the supply chain was able to respond faster
- Korean suppliers, as a group, with an average annual growth of 36%, outperformed the market by a long way. Benefited from memory market and other suppliers' inability to deliver

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IC Highlights Q2 22

- The Semiconductor Industry Association (SIA) announced in Aug: worldwide sales of semiconductors totaled **\$152.5 billion** during Q2 22, an increase of **13.3%** over Q2 21 and **0.5%** more than Q1 22 (Market growth has slowed somewhat in recent months)
- SIA president John Neuffer said: “Global semiconductor sales were **robust** during the Q2 22 period, increasing across all major regional markets and product categories compared to Q2 21”
- Sales into the Americas continued to lead all regional markets in June, increasing by 29.0% year-to-year.
 - Japan (up 16.1%),
 - Europe (up 12.4%)
 - Asia Pacific/All Other (up 11.9%)
 - China (up 4.7%)



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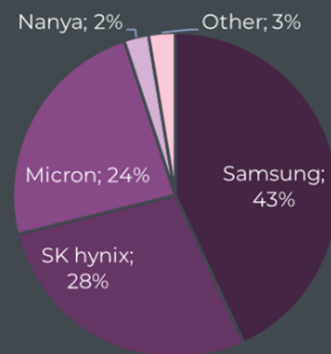
Memory Market Highlights Q2 22

Q2-22 DRAM MARKET HIGHLIGHTS

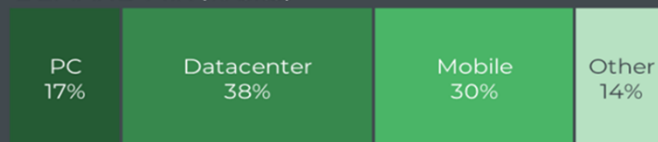
PERFORMANCE

ASP: \$0.49/Gb
REVENUE: \$25.1b
SHIPMENTS: 51.6 Eb
OPM: 45.7%

MARKET SHARES'



DEMAND MIX (% bits)

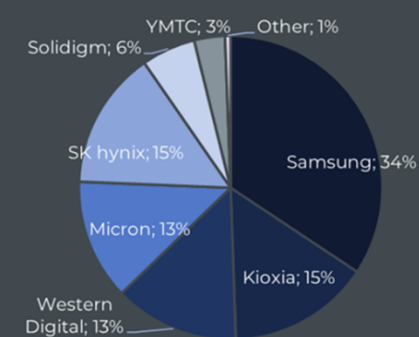


Q2-22 NAND MARKET HIGHLIGHTS

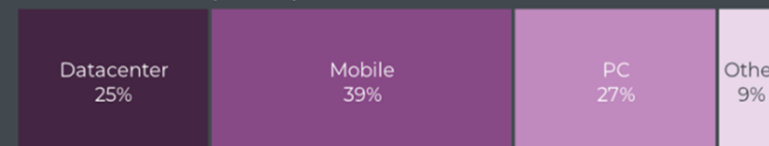
PERFORMANCE

ASP: \$0.110/GB
REVENUE: \$17.4b
SHIPMENTS: 158.7 EB
OPM: 20.7%

MARKET SHARES'



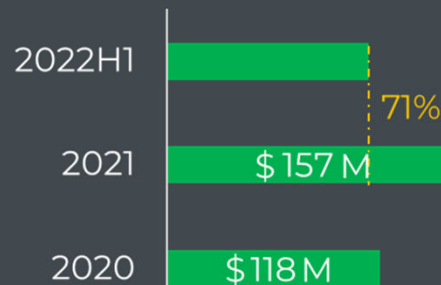
DEMAND MIX (% bits)



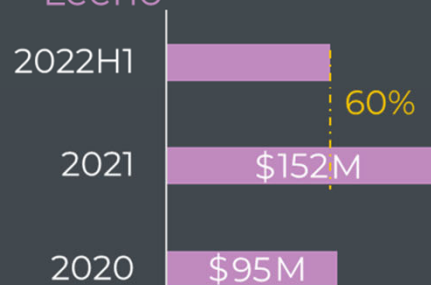
Socket Market Highlights Q1 & Q2 2022

H1 22 Socket Revs of Top Suppliers (Estimated based on IR data)

Yamaichi



Leeno

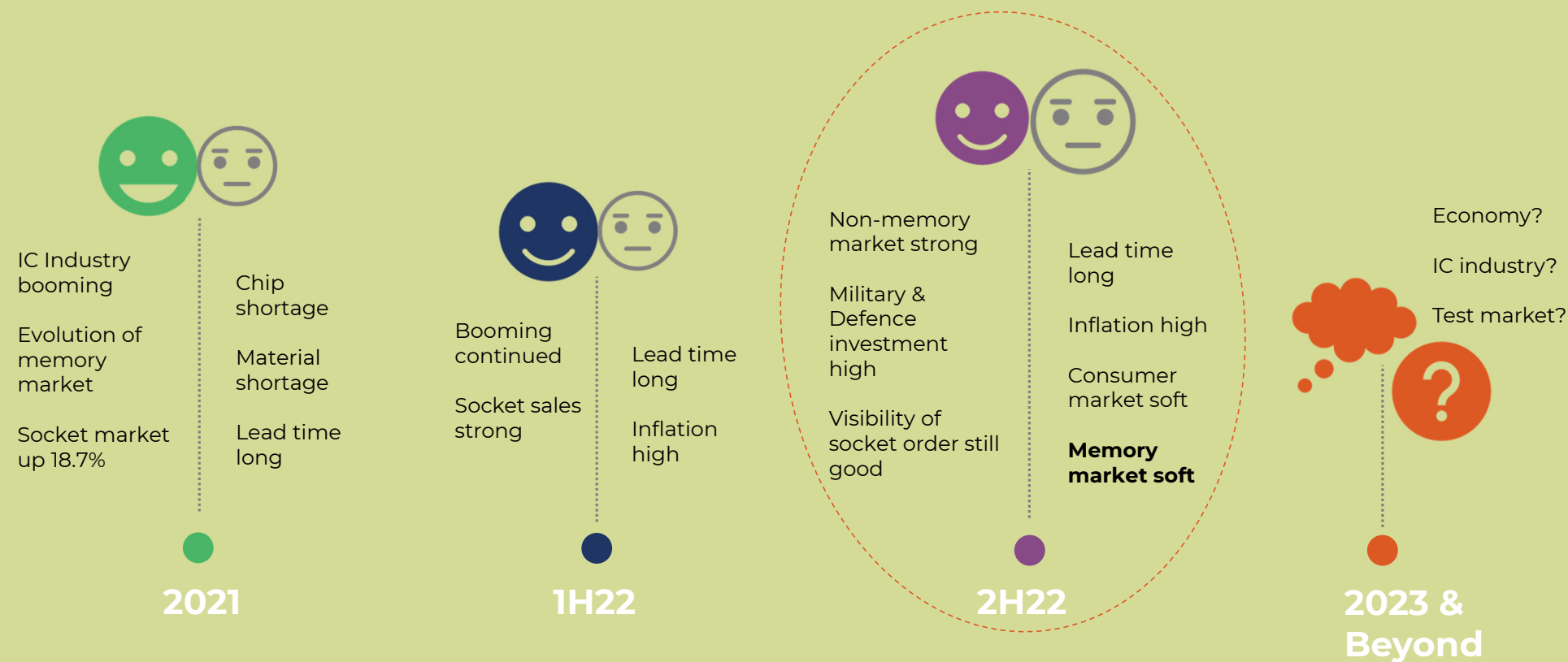


Enplas



- Top 3 suppliers in 2021 were all on track for strong growth in H1 22, providing a positive indicator to overall socket industry.
- We believe socket industry will continue the double-digit growth rate in revenues for the year overall under the excellent performance till now.

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The Market Took a Significant Turn from Q3 22

2022 – Memory market slowed down dramatically in Q3-22

- Worsening consumer economic sentiment, coupled with supply chain “kitting” challenges, has crippled smartphone and PC demand.
- OEMs, who have had elevated inventory due to H2 growth expectations and COVID-related supply chain concerns, are de-risking their balance sheets and rapidly depleting memory inventories which is resulting in a dramatic decline in DRAM demand.
- DRAM suppliers have grown increasingly pessimistic about demand through 2023 and are therefore reluctant to grow inventory to stave off price declines.
- Sapphire Rapids, Intel's forthcoming server platform, has been delayed from H2 2022 to H1 2023, thereby delaying the ramp of DDR5 and weakening overall server demand.

Revenue of DRAM for 2022 is expected to be up just **0.5%** to **\$95B** (vs. forecast of \$115 billion at the beginning of 2022) as prices are now expected to decline ~20% rather than increase ~10%

Revenue of NAND Flash for 2022 is expected to be up **3%** to **\$69B** (vs. forecast of \$83 billion at the beginning of 2022)

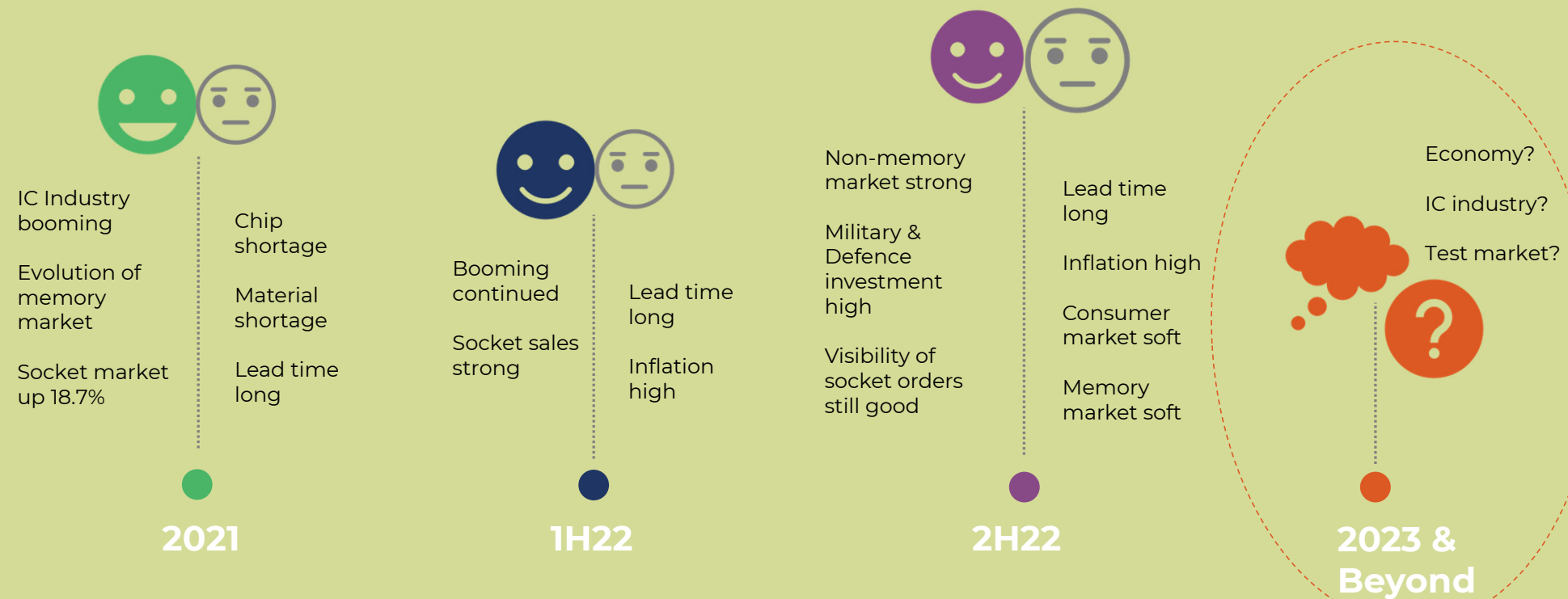


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Semiconductor Forecast Updated in Q3 22

Spring 2022 Q2 update	Amounts in US\$M			Year on Year Growth in %		
	2021	2022	2023	2021	2022	2023
Americas	121,481	150,064	157,302	27.4	23.5	4.8
Europe	47,757	54,451	56,203	27.3	14.0	3.2
Japan	43,687	49,880	52,374	19.8	14.2	5.0
Asia Pacific	342,967	378,843	396,481	26.5	10.5	4.7
Total World - \$M	555,893	633,238	662,360	26.2	13.9	4.6
Discrete Semiconductors	30,337	33,408	34,662	27.4	10.1	3.8
Optoelectronics	43,404	43,500	45,120	7.4	0.2	3.7
Sensors	19,149	22,319	23,184	28.0	16.6	3.9
Integrated Circuits	463,002	534,010	559,393	28.2	15.3	4.8
Analog	74,105	90,338	96,116	33.1	21.9	6.4
Micro	80,221	84,974	87,993	15.1	5.9	3.6
Logic	154,837	192,182	207,791	30.8	24.1	8.1
Memory	153,838	166,517	167,494	30.9	8.2	0.6
Total Products - \$M	555,893	633,238	662,360	26.2	13.9	4.6

Source: SWTS

- The World Semiconductor Trade Statistics (WSTS) has released its new semiconductor market forecast generated in August 2022
- The Worldwide Semiconductor Market is expected to increase **13.9%** in 2022 to \$633 billion, continuing to grow by **4.6%** in 2023.
- All geographical regions are expected to show growth in 2022, are expected to growth in 2023



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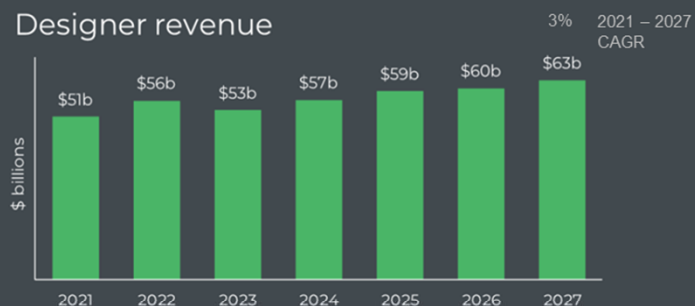
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Dynamics of Processor Market

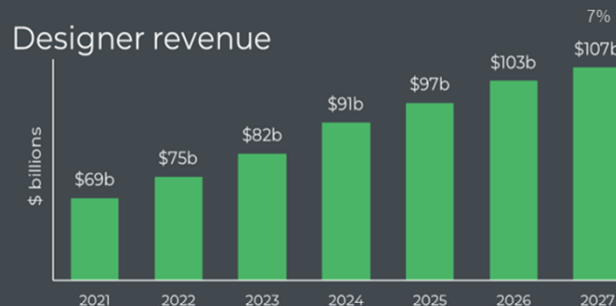
APU LONG-TERM DYNAMICS

Designer revenue



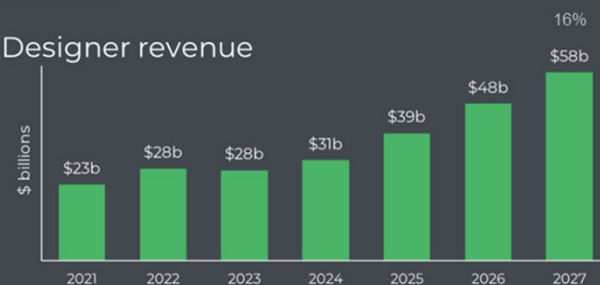
CPU LONG-TERM DYNAMICS

Designer revenue



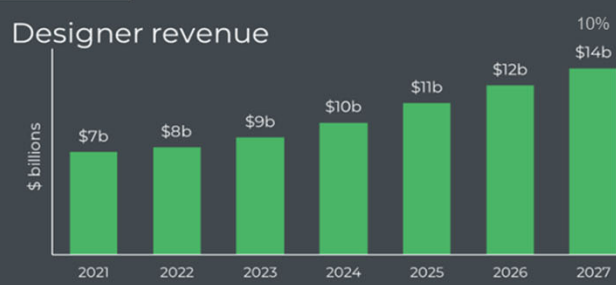
GPU LONG-TERM DYNAMICS

Designer revenue



FPGA LONG-TERM DYNAMICS

Designer revenue



Dynamics of Processor Market

APU: Scarcity has inflated prices slightly for 2020/2021, This momentum carried into 2022, but we see some softening as COVID lockdowns in China are again impacting the build of end-systems. Price decline and shipment decline expected to impact 2023. For 2024 and beyond expect price trends to return to matching process cost increases. Designers are expected to realize revenue growth.

CPU: This is a market generating nearly \$70B annual revenue. Despite the expected decline of client units, server revenues should more than offset this effect growing expect CPU revenue to \$107B by 2027 with CAGR of 7%.

GPU: Have seen strong demand-driven price increases in 2021. Expect GPU revenues to level-off as client computing systems return to pre-pandemic shipment numbers and the values of cryptocurrencies have fallen. By 2024 datacenter GPU momentum will push the overall industry across the \$30B, buoyed by AI-centric applications.

FPGA: Mainstream FPGA is a relatively stable market, buoyed by 5G and networking trends, as well as growth in industrial applications. As FPGAs are desired for acceleration in networking, data center, and ADAS applications, we expect healthy growth in these higher priced segments.

Burn-in Socket Market Forecast



- Demand for burn-in sockets is experiencing a revival after several years (2010 to 2020) of stagnation
- Increased test times and the use of expensive burn-in sockets for high pin count and high pin density packages used for non-memory applications is pushing up revenues
- 2022, revenues are expected to up 10%. While revenues in 2023 are forecast to be up 7%
- Long-term growth trend now in excess of 4%

Test Socket Market Forecast



- The adoption of 100% System Level Test for a growing number of applications has provided a boost for test socket suppliers
- Increased test times and the rollout of large packages with high pin counts used for non-memory applications are pushing up revenues
- The fast growth of complex test sockets for 5G is a key driver for the next five years
- Long-term growth trend now in excess of 6.3%

Summary

- The memory market slow down brought uncertainty to IC / semiconductor industry in the 2nd half of 2022 and may extend into 2023. Forecasted revenues for 2022 are flat to up slightly which is more related to soft pricing environment instead of weak unit shipments.
- Concerns about rising inflation, global recession, trade wars, and the conflict between Russia and Ukraine is impacting the market. We believe the overall industry will still grow at double-digit growth rates in 2022, but not as high as 2021.
- The cyclical nature of the semiconductor industry means the recovery will be due at the end of 2023. However, strong demand from end markets will drive positive long-term growth over the next 5 years.
- This is a fast changing market. Test strategies, testing technologies, and market drivers are changing at a pace never seen before. Now is the time to make sure you have the latest information so that you can make the right decisions quickly.



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