Taiwan Semiconductor Manufacturing Company Limited

A World Leader in Semiconductor Manufacturing

NYSE: TSM

November 2023

Current Share Price: $98.98

ADR Ratio (ORD:DR): 5:1

FY 2024 Target Price: $117.05

Safe Entry Price: $87.5-$95

Implied Upside: 23.21% - 33.7%

TEXAS A&M UNIVERSITY

tsmc

TSMC Overview

Business Overview

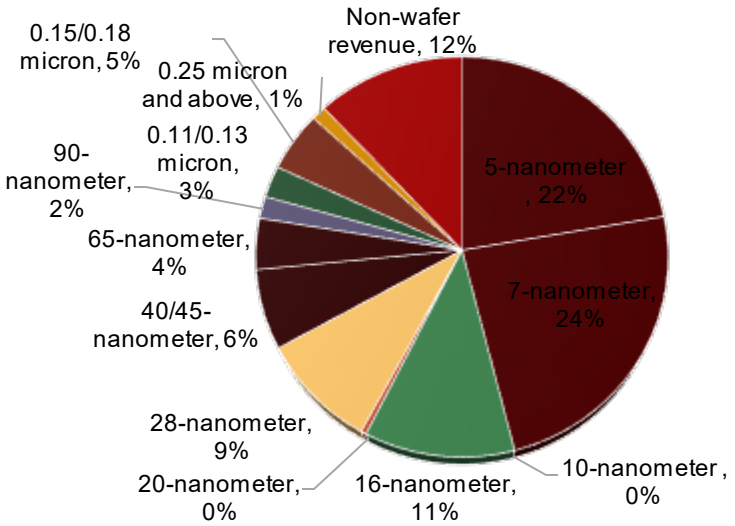
- TSMC, established in 1987, pioneered the pure-play foundry business model with an exclusive focus on manufacturing its customers' products.
- TSMC is the world's largest semiconductor foundry, with a market share of over 50%.
- TSMC's growth was mainly driven by the continued expansion of 5G and high-performance computing (HPC)-related applications.
- In 2022, the Company manufactured 12,698 different products using 288 distinct technologies for 532 different customers.
- TSMC's customers are Apple, Qualcomm, AMD, Broadcom, Nvidia

Key Stats

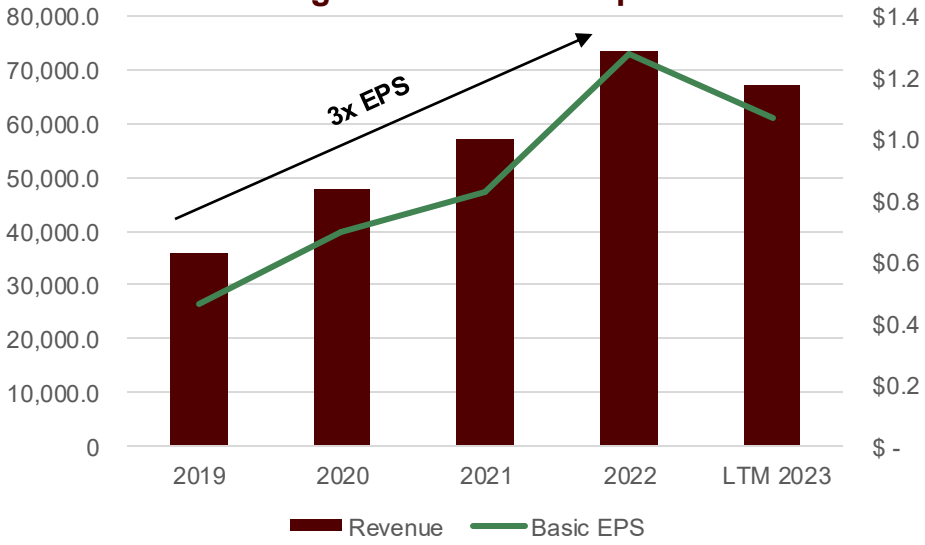
Market Cap: $469.8B	LTM Revenue: $67.17B
Enterprise Value: $453.56B	LTM EBITDA: $45.58B
Price/Share: $18.12	Price/ADR: $98.98*
Profit Margin: 41.4%	

Note: Metrics are taken from CapIQ which might be different from other

Revenue Breakdown by Resolution



Revenue and EPS growth/recent comp news



*Ticker price from google

Industry Overview

Opportunities with the Industry

- **Increasing demand for semiconductors:** The demand for semiconductors is growing rapidly due to the proliferation of electronic devices, such as smartphones, tablets, laptops, and wearable devices.
- **Advancements in semiconductor technology:** Semiconductor technology is constantly evolving, with new and more complex ICs being developed all the time. This requires foundries to invest heavily in research and development to stay ahead of the curve.
- **Miniaturization of semiconductors:** Semiconductors are becoming increasingly smaller and more complex, which is making them more expensive to manufacture.
- **The rise of fabless semiconductor companies:** Fabless semiconductor companies are becoming increasingly important in the semiconductor industry, as they are able to design ICs more quickly and efficiently than traditional IDMs (integrated device manufacturers). This has led to an increased demand for foundry services
- **Government Subsidies:** New government subsidies designed to support capabilities for manufacturing advanced chips. Taiwan government allows local chipmakers to turn up to 25 percent of their annual research and development expenses into tax credits

Challenges within the industry:

- **The high cost of capital:** The cost of building and operating a fab is very high, which is making it difficult for new companies to enter the industry.
- **The risk of obsolescence:** The semiconductor industry is constantly evolving, and companies must constantly invest in new technologies to stay competitive.
- **The geopolitical landscape:** The semiconductor industry is highly concentrated in a few countries, which makes it vulnerable to geopolitical risks.

Industry Growth Rate

- The global semiconductor market is expected to grow from $622.3 billion in 2022 to $1 trillion by 2030.
- The demand for semiconductors is expected to grow at a CAGR of 8.6% from 2022 to 2030.
- The Asia-Pacific region is expected to be the fastest-growing market for semiconductors, with a CAGR of 9.2% from 2022 to 2030.

Investment Thesis

Market leader in a growing industry

- TSMC captures ~55% of the semiconductor foundry industry and is expected to grow at a CAGR of 8.5% over the next five years, driven by the increasing demand for chips in a wide range of products, including smartphones, computers, data centers, and IoT devices

Leading-edge Technology

- TSMC has a significant competitive moat due to its technological leadership, scale, and customer relationships. The company is one of the few foundries in the world that can produce chips at the most advanced nodes, such as 5nm and 3nm. TSMC also has a long history of working with the world's leading chip designers, such as Apple, Nvidia, and AMD
- TSMC started production of 3nm chips in 2023 and its's on track to start producing 2nm chips by 2025

Growth in Emerging Technologies

- TSMC is benefiting from several secular trends, such as the growth of 5G, artificial intelligence, and the Internet of Things. These trends are driving demand for more powerful and sophisticated chips, which TSMC is well-positioned to supply

Growth Outlook by Platform

POSITIVE DEMAND AND RIGHT PRODUCT-RIGHT TIME

Platform	Revenue (%)	Outlook	Our view
Smartphones	45%	• In short-term, there is slow down in 5G adoption and prolonging replacement of 4G. • Over long-term, 5G implementation is inevitable along with the emerging features that will boost the smartphone sales	
High Performance Computing (HPC)	25%	• Major HPC unit shipments declined 11% in 2022, due to prolonged high inflation, macro-economic uncertainty and inventory overbuilt, all resulting in weak demand on the consumer side. • Over long-term, to accommodate energy efficient computing there is requirement for higher performance and more power-efficient HPCs.	
Internet of Things (IoT)	15%	• With accelerated digital transformation, IoT unit shipments grew 18% in 2022, with smart health devices, smart retail, and smart manufacturing as the major growth drivers. • Overall, as IoT devices take on more AI functions, they will require higher performance but lower power controllers, connectivity ICs and various types of sensors.	
Automotive	10%	• The entire automotive industry is moving toward “greener, safer and smarter,” which will accelerate the adoption of electric vehicles (EVs), advanced driver assistance systems (ADAS) and smart cockpit/infotainment systems architecture. • TSMC offers a wide variety of relevant process technologies to enable customers to deliver competitive products in the automotive market.	
Digital Consumer Electronics (DCE)	5%	• While some high-end areas such as large screen, 120Hz/144Hz high frame rate TV, voice AI control and WiFi 6 connectivity will continue to show good growth, fears of economic recession may stifle overall recovery. • Regardless of the timing of the recovery, TSMC advanced technologies will continue to enable DCE customers to create and differentiate their innovative products	

Growth Opportunities & Competitive Advantages

Competitive advantages

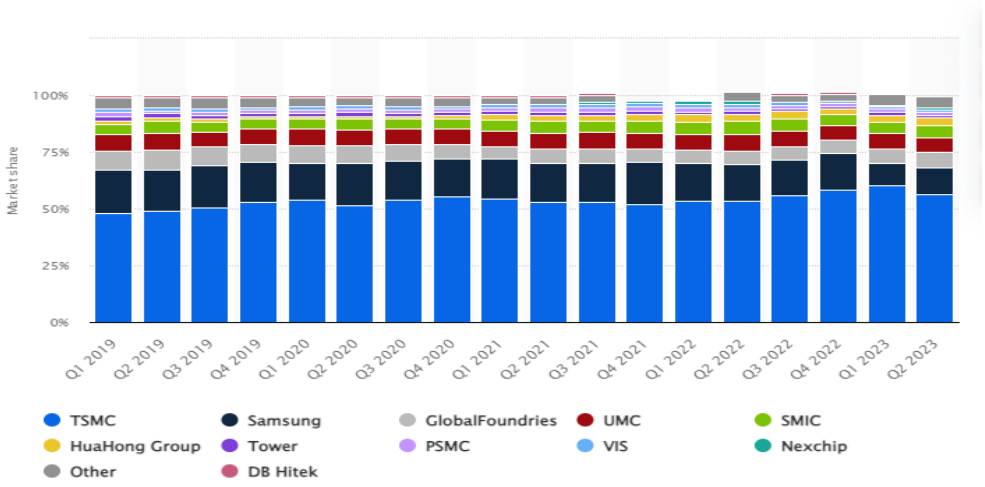
- **Technological leadership:** TSMC is the world's most advanced semiconductor manufacturer, giving it a competitive edge over rivals.
- **Global manufacturing presence:** TSMC has fabs in multiple countries, reducing supply chain risks and expanding market reach.
- **Commitment to innovation:** TSMC continuously invests in R&D to maintain its technological lead.
- Large volume, economies of scale
- Low cost and Trust of service & quality
- First-mover advantage in advanced chip manufacturing technology

Growth opportunities

- Expanding into automotive and industrial semiconductor markets
- Developing new technologies like advanced packaging and 3D chip stacking
- Acquiring other semiconductor companies to expand product portfolio and access new technologies
- Expanding manufacturing capacity in Taiwan, Arizona, and Japan to meet growing demand and maintain market leadership

Dominant Market Share

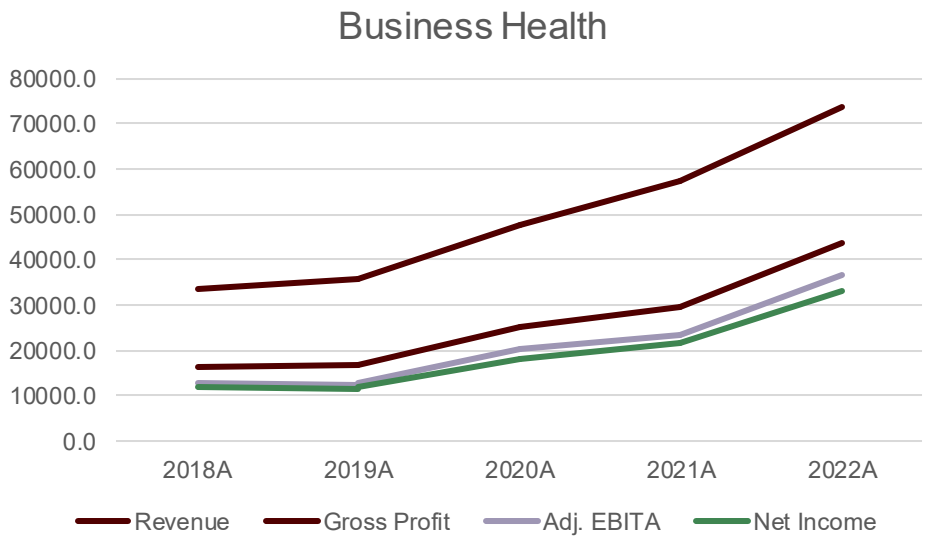
- Market Share over 50%
  - In 2017, the company held a market share of 48.6%. This grew to 53.1% in 2021 and 55.5% in 2022. In 2023, TSMC's market share is expected to reach 56.5%.



Details: Worldwide; 2017 to 2023

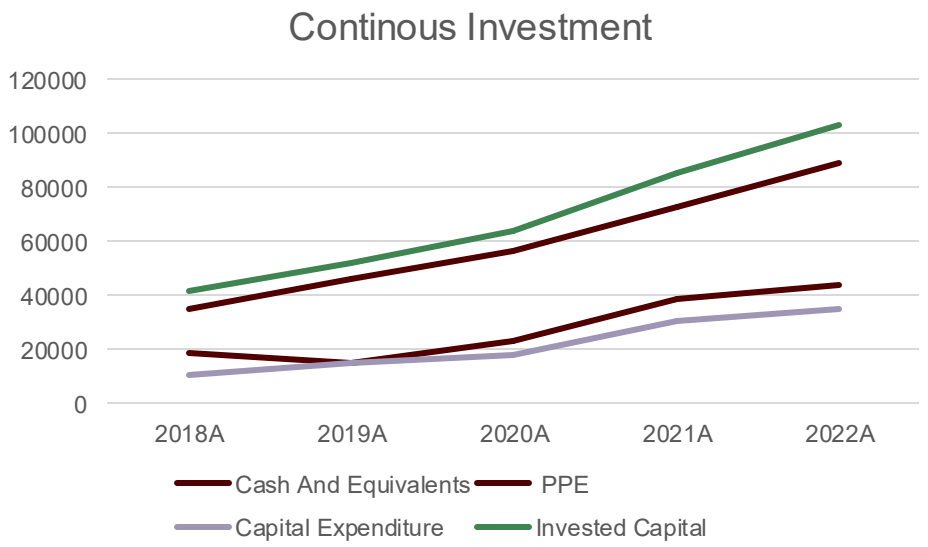
Source: Statista

TSMC's Performance



- 28% YoY revenue growth over last 4 years
- Earnings follow the same trend showing the capability of how profitable the business is

- This business requires continuous investment in R&D and PPE so being cash rich is a competitive advantage



Valuation

	12/31/2024	12/31/2025	12/31/2026	12/31/2027	12/31/2028	12/31/2029	12/31/2030	12/31/2031	12/31/2032			
Market Value Growth	13.00%	13.00%	13.00%	4.95%	4.95%	4.95%	4.95%	4.95%	4.95%			
Market Size	169544.66	191585.47	216491.58	227212.25	238463.80	250272.52	262666.02	275673.24	289324.58			
Market Share	50%	53%	56%	60%	64%	68%	72%	77%	83%			
Revenue	84000	100800	120960	135475	151732	169940	190333	213173	238754		Growth Rate	5%
Revenue Growth	-5%	20%	20%	20%	12%	12%	12%	12%	12%		Re	11%
Adj EBITA	34713.0322	41655.63864	49986.76636	55985.17833	62703.39973	70227.80769	78655.14462	88093.76197	98665.01341		Terminal Value	1041985
Adj. EBITA Margin	41.33%	41.33%	41.33%	41.33%	41.33%	41.33%	41.33%	41.33%	41.33%		PV(Terminal Valu	417564.8
Effective Tax Rate	10%	10%	10%	10%	10%	10%	10%	10%	10%			
NOPAT	31134.09556	37360.91467	44833.0976	50213.06931	56238.63763	62987.27415	70545.74705	79011.23669	88492.58509			
FCF Conversion	53%	54%	55%	56%	57%	59%	60%	61%	62%			
Free Cash Flow	16516.63769	20216.36454	24744.83019	28268.49401	32293.92756	36892.58284	42146.08664	48147.68938	55003.92035			
Years From Today	1.123287671	2.123287671	3.123287671	4.123287671	5.123287671	6.123287671	7.123287671	8.123287671	9.123287671			
Discount Rate	10.54%	10.54%	10.54%	10.54%	10.54%	10.54%	10.54%	10.54%	10.54%			
Discount Factor	0.89352	0.80830	0.73121	0.66147	0.59839	0.54132	0.48969	0.44299	0.40074			
Present Value of Free Cash Flows	14757.90938	16340.90768	18093.70533	18698.8814	19324.29865	19970.63409	20638.58736	21328.88152	22042.26379			
Implied Entreprise Value	588760.86											
Debt	29,132.70											
Minority Interest	760.348											
Cash + ST investments	48,207.58											
Implied Equity Value	607,075.39											
Shares Outstanding	25932.07											
Implied Value/Share	23.41021715	ADR Price	117.0510858									
Current share price	98.98											
Implied Upside	18.26%											

DCF Valuation

Risk & Mitigation

Economic Downturns & Geopolitical Risks

- Economic Downturns: The semiconductor industry is cyclical, and TSMC's business is highly correlated with the overall health of the global economy. An economic downturn could lead to a decrease in demand for semiconductors, which would hurt TSMC's revenue and profits.
- Semiconductor foundry industry is currently going through inventory correction caused by excess inventory levels accumulated during COVID-19 pandemic time due to supply chain complexities.
- Geopolitical risks: Taiwan is a politically sensitive region, and there is a risk that the country could be involved in a conflict with China. This could disrupt TSMC's operations and supply chain.

Mitigations

- TSMC is diversifying its manufacturing footprint across multiple countries to mitigate geopolitical risk and ensure a stable supply of semiconductors.
  - Arizona, USA: Building a $12 billion fab expected to start production in 2024, producing 5-nanometer chips.
  - Japan: Building a $7 billion fab expected to start production in 2024, producing 3-nanometer chips.
  - Germany: Considering building a fab to produce 3-nanometer chips.
  - Singapore: Expanding existing fab to produce 3-nanometer chips at a cost of $3.5 billion.

Experienced Management Team

Dr. Mark Liu

Chairman

Dr. Mark Liu is Chairman of Taiwan Semiconductor Manufacturing Co. Ltd. (TSMC). Prior to assuming this post, he was President and Co-CEO of TSMC from 2013 to 2018, where he oversaw TSMC's leading-edge technology development, and was Co-Chief Operating Officer from 2012 to 2013.

Dr. C.C Wei

Chief Executive Officer

Dr. C. C. Wei is Chief Executive Officer of Taiwan Semiconductor Manufacturing Co. Ltd. (TSMC). Prior to this appointment, Dr. Wei was TSMC's President and Co-CEO from November 2013 to June 2018 and Co-Chief Operating Officer from March 2012 to November 2013. From 2009 to 2012, he was TSMC's Senior Vice President of Business Development.

Key Takeaways

1. Extensive experience in the semiconductor industry: Mark Liu and C.C Wei have a long and distinguished career in the semiconductor industry, spanning over three decades.

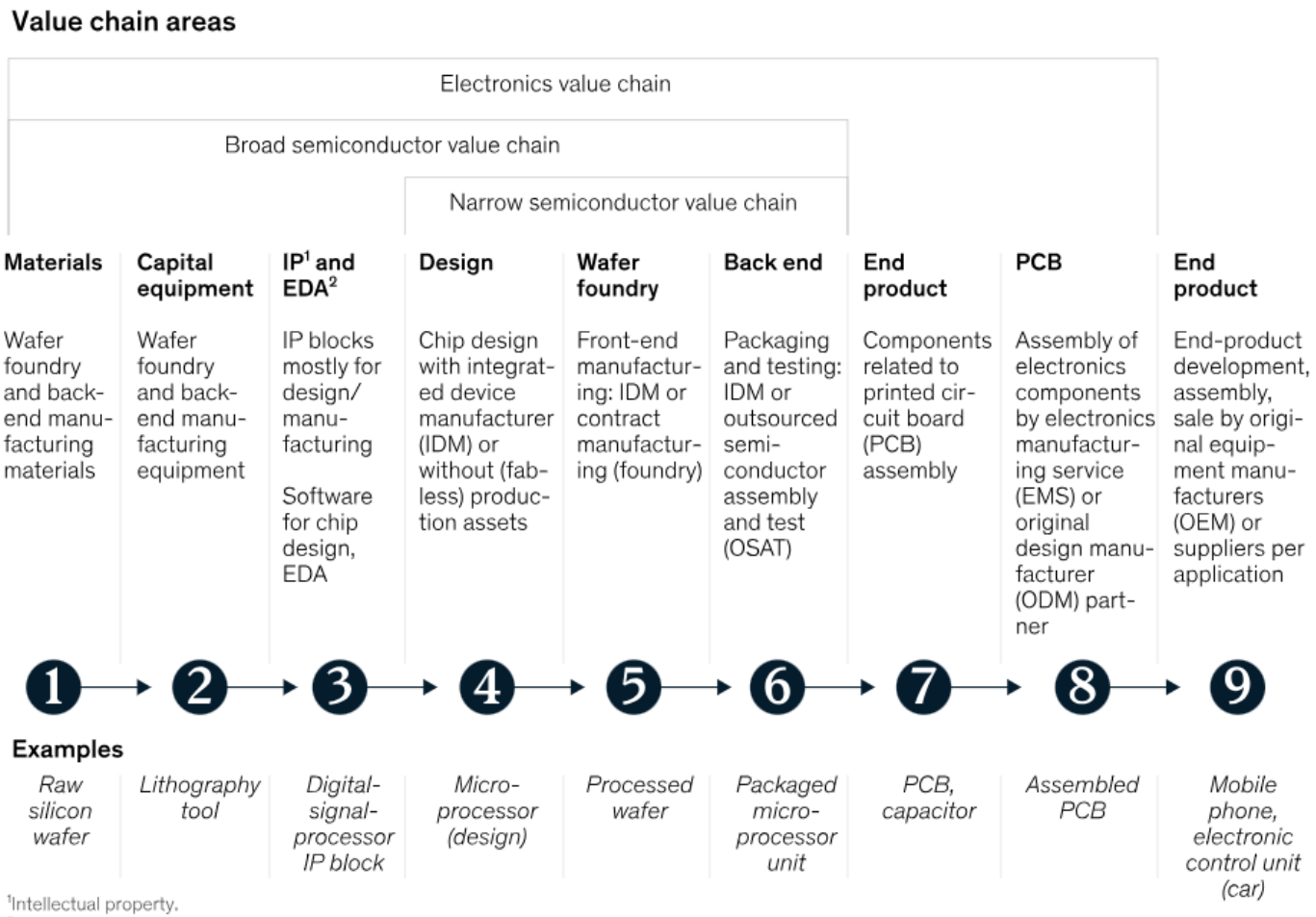
2. Strong track record of innovation: Dr. Liu is credited with establishing TSMC's first 12-inch fab and leading the development of the company's GIGAFAB® operations.

Insider Holdings

Holder	Common Stock Equivalent Held	% Of CSO	Market Value (USD in mm)
National Development Fund, Executive Yuan	1,653,709,980	6.377	29,161.8
BlackRock, Inc. (NYSE:BLK)	1,268,404,066	4.891	22,367.3
Capital Research and Management Company	906,978,412	3.498	15,993.8
GIC Private Limited	860,386,401	3.318	15,172.2
Norges Bank Investment Management	411,961,838	1.589	7,264.6
FMR LLC	363,191,521	1.401	6,404.6
New Labor Pension Scheme	332,983,055	1.284	5,871.9
The Vanguard Group, Inc.	328,747,745	1.268	5,797.2
Yuanta Securities Investment Trust Co., Ltd.	268,532,273	1.036	4,735.3
JP Morgan Asset Management	214,990,473	0.829	3,791.2
Fubon Life Insurance Co., Ltd., Asset Management Arm	194,197,221	0.749	3,424.5
Baillie Gifford & Co.	192,875,158	0.744	3,401.2
Fidelity International Ltd	182,425,151	0.703	3,216.9
Invesco Ltd. (NYSE:IVZ)	168,134,252	0.648	2,964.9
T. Rowe Price Group, Inc. (NasdaqGS:TROW)	158,340,403	0.611	2,792.2
Swedbank Robur Fonder AB	137,747,380	0.531	2,429.1
Geode Capital Management, LLC	107,904,861	0.416	1,902.8
Schroder Investment Management Limited	98,950,956	0.382	1,744.9
abrdn plc (LSE:ABDN)	98,806,596	0.381	1,742.4
Teachers Insurance and Annuity Association-College Retirement Equities	94,073,930	0.363	1,658.9
Dimensional Fund Advisors LP	93,144,490	0.359	1,642.5
UBS Asset Management AG	79,014,597	0.305	1,393.4
Fubon Asset Management Co., Ltd.	76,489,752	0.295	1,348.8
Wellington Management Group LLP	75,692,886	0.292	1,334.8

APPENDIX

Semiconductor Value Chain



[1]Intellectual property.
[2]Electronic-design automation.

McKinsey & Company

Competitive Landscape

Competitors

- Samsung
- Intel
- Global foundries
- SMIC
- UMC
- Powerchip Semiconductor Manufacturing

TSMC's Advantage

- Invests heavily into R&D, which has led to TSMC developing the 3-nanometer node, which is the most advanced node currently in production
- Works more closely with their customers and tailors manufacturing processes to meet customer demands accordingly
- Currently operate the most advanced semiconductor fabrication facilities, allowing TSMC to meet high demand for advanced chips while maintaining cost-effectiveness
- Customers already have long-standing relationship with TSMC; switching chip foundries would be a very time-consuming and expensive process for them
- In 2022, yield and DPSC (defects per square centimeter) for their 5 nm process were 92% and 0.10 respectively, beating out giants like Samsung and Intel

Customers

Apple

NVIDIA

Qualcomm

AMD

BROADCOM

MEDIATEK

intel