

Semiconductors: The driving force of technology

DIGITAL ENGAGEMENT TEAM

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TRADING MATTERS SERIES: NEWS FOCUS

The summary and impact of a major news event

Semiconductors, also known as microchips or integrated circuits, form the backbone¹ of the tech-reliant world that we live in. These vital technology enablers can be found in the electronics gadgets and devices that we use, from computers, mobile devices to air-conditioners just to name a few.



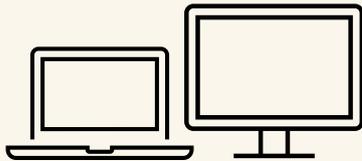
Why are semiconductors in shortage?



And currently, they are in short supply. A combination of longstanding issues and immediate setbacks blindsided the Semiconductor industry, causing a ripple effect that has handicapped many industries heavily reliant on microchips.²

Immediate setbacks

Higher demand for microchips from electronic manufacturers as the need for work-from-home electronic devices soared during the pandemic.³



Automakers and smartphone manufacturers cut orders for microchips at the start of the pandemic in anticipation of a drop in demand. So, when demand surged unexpectedly in late 2020, they struggled to keep up.⁴

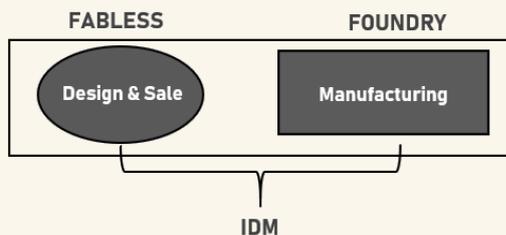


Fires, droughts and cold spells in various countries forced plant shutdowns and outages.^{3,4,5}



Longstanding issues

'Fabless' Business Model



Semiconductor companies are classified into 3 types: "Fabless" companies; focusing only on design and sale of chips, foundries which focus on the actual manufacturing process and Integrated Device Manufacturers which handle both design and manufacturing.^{6,7}

With many companies transitioning into "fabless" companies, global access to chips hinges on a few foundries.

Driving the future

Beyond the current chip shortage, many opportunities lie ahead for the semiconductor industry over the longer horizon as technological advancements continue to drive the world forward.⁸

Increasing adoption of emerging technologies like Artificial Intelligence (AI), Internet Of Things (IOT), 5G, connected cars will drive the future growth of the industry, according to a KPMG report on the outlook of the Semiconductor industry.

A survey conducted by KPMG found that 72% of industry leaders believe that 5G will be a prominent driver of industry revenue within the next two years.

On top of that, Businesswire reported that the Semiconductor industry is primed to grow by US\$90.80bn from 2020 to 2024 at a compound annual growth rate (CAGR) of more than 4%.



Applications driving semiconductor company revenue over the next year

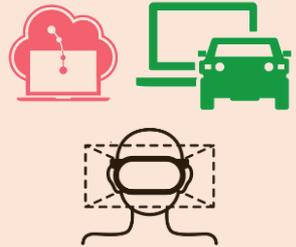
(Averages on a 1 to 5 scale with 1=Not at all important and 5=Very important.)

Source: KPMG



Source: BusinessWire

Some of the emerging technologies that may shape the Semiconductor industry in the future^{10,11,12:}

 <p>Artificial Intelligence (AI)</p>	<p>From virtual assistants like Siri to high frequency trading or spotting potential tumors in patients, the application of AI is ubiquitous in the world we live in. According to PWC, the market for AI-related semiconductors is expected to grow to more than US\$30bn by 2022 at a compound annual growth rate (CAGR) of around 50%.</p>	
 <p>Internet of Things (IoT)</p>	<p>By connecting various things to the internet, data can be collected and shared, providing better insights, new opportunities, cost reduction and efficiency. It can be something as innocuous as a lightbulb being controlled from your phone, or something more complex like sensors keeping an airplane flying. The IoT chip market is forecasted to hit US\$34.74bn by 2028 according to Globenewswire.</p>	
 <p>5G</p>	<p>The next generation of telecom network built for connectivity and speed will enable improvements to technologies like cloud computing, self-driving cars, and AI, among others, according to Qualcomm. The global 5G chipset market is expected to grow at a compound annual growth rate (CAGR) of 63.4% from 2020 – 2027 based on a report by Grand View Research.</p>	

Developments and trends (US & China)

For years, the US has been a leader in the semiconductor industry, controlling 48% of the market share in terms of revenue as of 2020, according to the Semiconductor Industry Association, while Reuters stated that China is the largest importer of semiconductors.

As such, semiconductors serve as the cornerstone for the technological ambitions of both US and China, representing a crucial technological vulnerability for both countries based on an article by Foreign Policy. And as tensions mount between the two countries, it may risk splintering the global semiconductors supply chain and disrupting the semiconductor industry, as reported by CNBC.



- US President Joe Biden stated that he would seek funding of USD\$37 billion to boost chip manufacturing in the US and signed an executive order to tackle the global semiconductor chip shortage.¹³
- A US national security commission has recommended that US coordinate with other countries such as Japan and Netherlands to restrict export licenses of advanced chipmaking tools to China.¹⁴



- Restrictions imposed by the US on Chinese companies has impacted production and sales at several Chinese firms.¹⁵
- In its 14th 5-year plan, China has stated that it will focus on research and development in integrated circuit design tools along with key equipment and materials to build up self-reliance in the semiconductor industry.¹⁶

Developments and trends (Company)

A growing number of tech companies have started to design their own chips with a view that custom-designed chips may bring performance advantages and may be more suitable for addressing issues and needs specific to their own products as compared to off-the-shelf chips, according to Bloomberg. Custom-made chips may also have potential cost-savings benefits as reported by The Wall Street Journal, providing another layer of incentives for companies.

According to Reuters, Chinese technology giants are also revving up their efforts to design their own chips in line with China's ambitions to be self-sufficient in the semiconductor industry.

Examples of some companies that developed, or are developing in-house chips:

<u>Developed their own chip</u> (US)	<u>Developed their own chip</u> (China)
	
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Source: Bloomberg, CNBC, Reuters, SCMP, TechCrunch

Companies in the Semiconductors Industry

■ Fabless
 ■ Foundry
 ■ IDM
 ■ Equipment

Below are the top companies based on Market Cap in their respective segments and geographical locations



Source: Bloomberg, as of 1 April 2021, 12 pm (SGT)

Nvidia Corp (NVDA US)



- Dominates the US market for graphics cards. (McKinsey)
- Recently partnered with multiple EV makers such as NIO, Li Auto and Xpeng in developing their smart, electric fleets with the NVIDIA Drive platform. (NVIDIA)

Intel Corp (INTC US)



- Dominates the market for desktop and laptop CPUs. (McKinsey)
- One of the few semiconductor IDM companies that both designs and manufactures its own chips and is the largest semiconductor manufacturer by revenue. (Reuters)
- Recently announced plans to re-enter the foundry business and is key to US' plans to pursue leadership for the technology industry. (Bloomberg)

ASML Holding – US ADR (ASML US)



- World's largest supplier of lithography equipment for making chips. (Reuters)
- It is also the world's only supplier of extreme ultraviolet lithography (EUV) machines that can make the next generation of cutting-edge semiconductors. (Bloomberg)

Qualcomm Inc (QCOM US)



- Leader in the smartphone system-on-a-chip market. (McKinsey)
- It was also the biggest 5G chipset vendor in Q3 2020. (Counterpoint Research)

Applied Materials Inc (AMAT US)

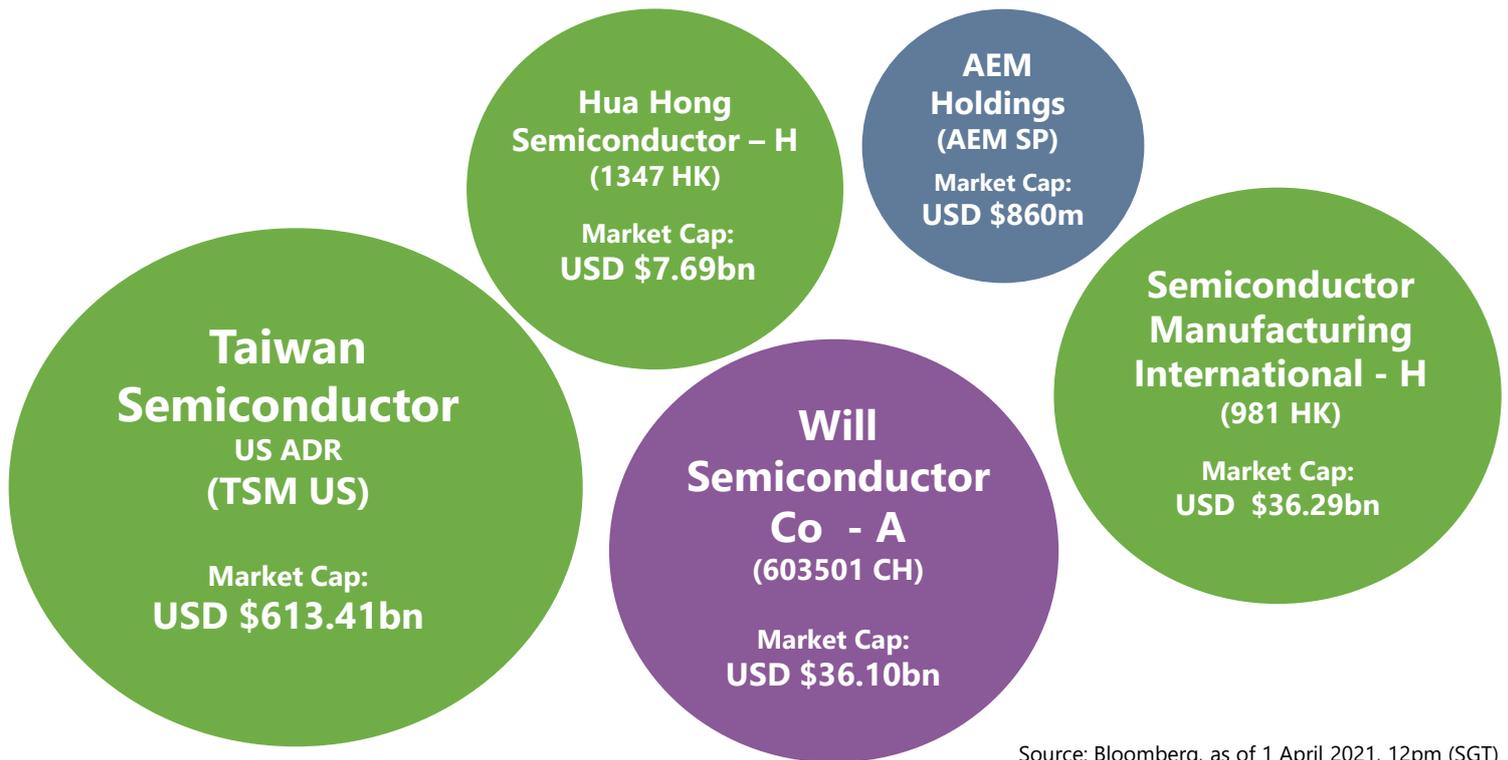


- Largest semiconductor equipment company by revenue, with a broad portfolio across etch and deposition machines as well as metrology and inspection tools. (Motley Fool)
- Serves the memory and display industries as well as foundries that produce processors. (Motley Fool)

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Taiwan Semiconductor (TSMC) – US ADR (TSM US)



- Top manufacturer for chips at ten nm or below. (McKinsey)
- Controls more than 50% of the global foundry market. (Nikkei Asia)

Semiconductor Manufacturing International (SMIC) – H (981 HK)



- China's largest and most important chipmaker. Recently announced plans to build a new factory in Shenzhen costing \$2.35 billion. (Bloomberg)
- Blacklisted by US, resulting in restriction on importing technology from American companies, dealing a blow to its ability to catch up to the most cutting-edge chipmaking technology (CNBC)

Will Semiconductor Co – A (603501 CH)



- Largest semiconductor company listed in China after SMIC. (Financial Times)
- Its products are primarily applied in mobile communication, vehicle-mounted electronics, security, internet communication and household appliances, among others. (Bloomberg)

Hua Hong Semiconductor – H (1347 HK)



- Largest semiconductor company listed in HK after SMIC. (Financial Times)
- Its products are applied in a variety of technologies from general microcontroller (MCU), Type-C interface chips, image stabilization chips to Internet of Things (IoT) and artificial intelligence, among others. (Bloomberg)

AEM Holdings (AEM SP)



- The biggest and most traded semiconductor stock in 2020 on the SGX.
- It also made the list of Forbes Asia's 200 Best Under A Billion List for the first time in FY2019. (SGX)

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