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Tech wars: US-China rivalry for electronics out to 2035

EXECUTIVE SUMMARY

The US-China tech war has intensified dramatically since 2017, employing a full spectrum of measures from tariffs and export controls to restrictions on market access in a race for technological dominance that is reshaping the global electronics landscape. While our calculations indicate a substantial shift in US imports away from China that has cost the latter close to USD150 billion in lost exports since 2017, they also suggest that underlying, mutual interdependence remains deeply rooted in the very structure of the industry: 29% of US semiconductor manufacturing machinery exports flow to China, and US electronics imports from Mexico, Taiwan and Vietnam incorporate a great deal of Chinese value-added.

If the ties connecting the US and Chinese electronics industries have proven more resilient than what headline bilateral trade figures might suggest, it is largely because the US administration's long-term drive to cut ties with China contradicts the short-term interests of corporate America and the world's most dominant electronics companies. We estimate that over the last decade US companies alone accounted for 54% of global electronics profits, a share that balloons to 88% when including their Japanese, South Korean, and Taiwanese peers. Meanwhile, despite surging sales and remarkable technological progress, Chinese companies only secured 7% of global industry profits and are still lagging far behind leaders in the all-strategic semiconductor segment. A major supplier of critical inputs, an unmatched manufacturing hub and one of the world's largest consumer markets for electronics, China resembles more a condition for, rather than a threat to, the profitability of dominant US electronics companies.

However, the assumption that current patterns are going to continue during the coming years is at complete odds with the deep resolve of the US and China to maintain or acquire technological leadership and reduce dependencies, often by using trade as a weapon. Such a belief also discounts the possibility of a major industry shake-up triggered by radical innovation, much like the one that played out at the dawn of the personal computing or smartphone era. To explore how an acceleration in US-China rivalry and potential disruptive innovation might transform the industry value chain, we have identified four scenarios: Tech Stalemate, Tech Cold War, Tech Race, and Tech Rift, each with different impacts on trade complexity, trade volumes and volatility in market shares.

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Tech Rift, the most extreme scenario, envisions a sharp escalation in US-China rivalry paired with the rise of a disruptive technology, resulting in an all-encompassing change in global supply chains, standards and markets. The divide could create two increasingly isolated ecosystems – one dominated by the US and its allies, the other by China – where countries and companies are compelled to choose sides.

Depending on the scenario, the countries dominating the electronics industry will need to employ a mix of coping, adaptation and transformative strategies to keep their competitive edge in the intensifying tech race. Such measures might include fiscal incentives to regionalise production, forging strategic partnerships to secure market access, investing in innovation ecosystems and recalibrating trade policies to align with shifting global dynamics. While the exact approach will vary according to region and alliance, each player faces unique challenges and opportunities to position itself effectively in this increasingly polarised landscape. Regardless of the exact scenario for the next ten years, electronics companies will have to navigate heightened risks of supply chain disruptions, foreign market access restrictions, geopolitical compliance pressures, standards divergence and investment constraints, all of which will play a part in exacerbating volatility in an already cyclical industry and adding a significant cost burden. Companies would be well-advised to pursue proactive supply chain diversification, devise contingency plans, empower regional subsidiaries with greater decision-making autonomy and flexibility, and reinforce risk management and compliance functions to enhance resilience and responsiveness within increasingly complex and localised trade environments.

SOME OF THE THINGS YOU'LL LEARN...

Between 2017 and 2024, China's market share in US electronic device imports fell from 59% to 36%, costing China nearly USD 150 billion in lost exports.

p.4

Despite growing restrictions on US technology exports to China, close to 30% of US semiconductor manufacturing machinery exports still go to the latter.

p.4

US companies have captured 54% of the profits generated by the global electronics industry over the past decade vs. a mere 7% for their Chinese competitors.

p.5

Until the 1990s, Japan controlled half the semiconductor markets, but the development of personal computers and later smartphones completely reshuffled the cards.

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Seven years into the Tech War: the conflict intensifies with mixed results

From campaign rhetoric on trade...

The electronics industry is a cornerstone of international trade and accounts for nearly USD 3,000 billion in exports, making it the most traded category of manufactured goods. It encompasses everything from semiconductors and other electronic components to servers, laptops, smartphones and TV sets. Over the past two decades, the sector has experienced robust growth, with global trade flows expanding at an average annual rate of 6%, driven by the increasing integration of information technology (IT) across all sectors of the economy and the dispersion of value chains worldwide[1].

Donald Trump's 2016 presidential campaign marked the beginning of a new era in the US-China trade relationship. Blaming China's unfair trade practices for much of the United States' USD 500 billion annual trade deficit, the then candidate Donald Trump ran a protectionist platform aimed at bolstering US manufacturing activity and forcing China to renegotiate trade terms. Seven months after he took office, Trump ordered an investigation by the US Trade Representative (USTR) on potential discriminatory trade practices by China. Published in March 2018, the results of the investigation found China guilty of engaging in unfair trade practices including intellectual property (IP) theft, forced technology transfers and cyber theft, among others, which justified the introduction of tariffs as a response to China's abusive practices.

Between March 2018 and January 2020, the US and China engaged in a series of tit-for-tat trade sanctions which took the share of Chinese imports subject to tariffs from 0.8% to 66% for an average tariff rate that jumped from 3% to 21% **(Table 1 next page)**. Both countries called a truce by signing the Phase One Agreement in January 2020 which required China to increase purchases of US goods by USD 200 billion, improve protection for intellectual property, curb forced technology transfers and open its financial markets, while maintaining most US tariffs, some of which were nonetheless reduced or delayed. Because electronic device trade with China alone generated a trade deficit of about USD 146 billion at the beginning of the first Trump presidency, devices including TV screens, smartphones and computers were largely covered by rising tariffs.

... to bipartisan consensus on tech

The 2019 decision to place Huawei on the US Entity List was a pivotal moment and signalled a shift in which national security and technological dominance concerns took on heightened significance. Although present earlier, these issues became more pronounced as the US government claimed alleged ties between Huawei and the Chinese government and military.

Although little known in the US owing to longstanding national security concerns, Huawei was the world's largest provider of telecommunications infrastructure equipment and the leader in 5G technologies, as well as the world's third-largest manufacturer of smartphones. The move had very practical consequences as Huawei would be effectively unable to purchase semiconductors from leading US companies, incorporate Google's

1 - See the appendix for a definition of the industry and its main segments and products

Table 1 - A non-exhaustive timeline of the US-China Tech War

Date	Event
August 2017	> The US Trade Representative (USTR) initiates an investigation into possible discriminatory trade practices carried out by China.
March 2018	> The USTR releases a report finding that Chinese trade practices warranted action. > The US applies new tariffs of 25% on about USD 50 billion of Chinese imports, including semiconductors and electronic goods.
August 2018	> The USTR extends tariffs to an additional USD 200 billion worth of Chinese goods, subject to a 10% increase, including a wider range of electronic components and goods.
May 2019	> The US Commerce Department places Huawei on the Entity List, citing national security concerns over Huawei's alleged links to the Chinese government and military. > The move bans US companies from selling or exporting technology to Huawei without a licence.
August 2019	> The USTR announces a 15% increase in tariffs on USD 300 billion of Chinese goods, taking effect in two phases, with a strong focus on consumer electronics, including smartphones, laptops and televisions.
October 2019	> The second phase of additional tariffs, covering USD 160 billion of imports and due to take effect in December 2019, is suspended. > The US Commerce Department adds Hikvision and Dahua, China's leading manufacturers of surveillance equipment, to the Entity List, citing their involvement in humanrights abuses in Xinjiang.
January 2020	> As part of the Phase One trade deal, China commits to increase purchases of US goods and services, limit technology transfers and improve IP enforcement. Tariffs on electronics are partially alleviated.
April 2020	> The US Commerce Department places Inspur, one of China's largest cloud computing and server manufacturers, on the Entity List. The decision came in the wake of national security concerns over the company's involvement in the Chinese government's surveillance programmes and potential ties to China's military.
November 2020	> The US Commerce Department adds DJI, the world's largest manufacturer of commercial drones, to the Entity List, citing concerns over national security and human rights abuses related to the company's involvement in surveillance activities in Xinjiang.
December 2020	> The US Commerce Department adds Semiconductor Manufacturing International Corporation (SMIC), China's largest chipmaker, to the US Entity List.
March 2021	> The Biden administration undertakes a review of US-China trade with a focus on electronics and supply chain security.
October 2022	> The US Congress passes the CHIPS and Science Act, allocating USD 52 billion in subsidies to reduce US dependence on Chinese and East Asian semiconductor manufacturing.
December 2022	> The US Commerce Department adds YMTC, a manufacturer of memory semiconductors, to the Entity List, citing concerns over national security and YMTC's alleged links to China's military.
July 2023	> The US Commerce Department adds Loongson, a Chinese state-backed semiconductor firm specialising in CPU design, to the Entity List.
August 2023	> The US imposes stringent export controls on advanced AI and semiconductor technology to China. These controls are aimed at curbing China's ability to develop high-performance computing capabilities that could be used for military and surveillance purposes.
May 2024	> The USTR publishes its review of the wave of tariffs targeting Chinese goods since 2018, stating it would continue tariffs on most products and suggest higher rates on USD 18 billion worth of Chinese goods, including semiconductors.

Source: Coface

Android operating system in its smartphones and tender for infrastructure projects in the US. Later in 2019, similar restrictions were placed on Hikvision and Dahua Technologies (surveillance equipment), as well as SenseTime (AI and face recognition technologies). In 2020, SMIC, China's largest homegrown semiconductor manufacturing company, and DJI, the world's largest manufacturer of commercial drones, were added to the US Entity List.

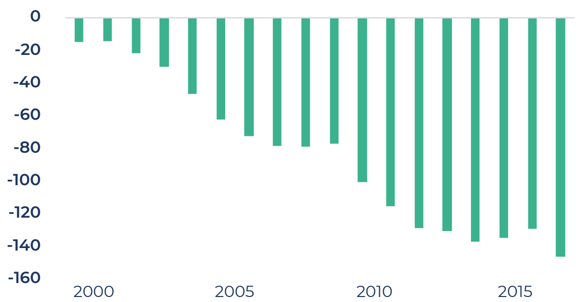
Reflecting bipartisan consensus, the Biden administration largely built on the legacy of the Trump administration by adding new restrictions justified by the same economic, technological leadership and national security concerns.

- Because they were found partially effective in addressing unfair trade practices while also encouraging supply chain diversification by the USTR, the tariffs remained largely in place. In 2024, another USD 18 billion of Chinese goods were targeted by increased import tariffs, including a 50% rate for semiconductors
- Meanwhile, the Entity List continued to grow as key Chinese technology companies such as memory chip specialist YMTC, chip design company Loongson and server manufacturer Inspur were added to the list in 2022 and 2023. Trade restrictions also placed greater emphasis on frontier technologies including advanced semiconductors, supercomputers and artificial intelligence.
- The 2022 CHIPS and Science Act, which allocated about USD 53 billion to boost US semiconductor manufacturing and research through a mix of tax credits and funding, included specific national security measures to prevent US companies from expanding advanced semiconductor manufacturing capabilities in countries viewed as a national security risk to the US.

Tariffs on Chinese imports have had a noticeable impact on the US trade structure

US electronics trade with China boomed after the country joined the World Trade Organization: bilateral trade grew from USD 20 billion in 2001 to USD 158 billion in 2017 to fuel a deficit that jumped from USD 15 billion to USD 146 billion, respectively **(Chart 2)**. China alone accounted for over 60% of the US electronic device trade deficit. Over the same period, China's share of global electronics exports climbed from 20% to 42% as the country became the industry's manufacturing heartland, home to a fast-growing domestic market and close to Japan, South Korea and Taiwan, three of the world's leading manufacturers of advanced electronic components.

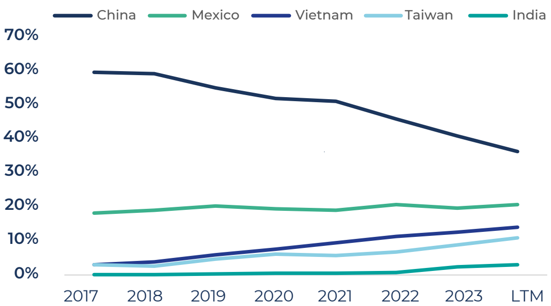
Chart 2 - US-China electronic device trade deficit *(USD billion)*



Sources: USITC, Coface

The deterioration in US-China relations has taken a massive toll on Chinese device exports to the US. Looking at US customs data at product level, we find that imports of Chinese electronic devices were slashed by 25% between 2017 and 2023, taking China's share of US electronic device imports from 59% to 41%, and even 36% from August 2023 to July 2024, a level last seen in 2005. US efforts to diversify away from China mainly benefited Vietnam (+10.1pp since 2017, 13.9% of imports from August 2023 to July 2024) and Taiwan (+5.9pp, 10.8% of imports), and to a lesser extent Mexico (+1.5pp, 20.6%) **(Chart 3)**.

Chart 3 - US imports of electronic devices by country of origin (%)



Sources: USITC, Coface

The dramatic increase in US imports from Vietnam, Taiwan, and Mexico prompted us to investigate whether a possible rerouting of Chinese electronic device exports to those same countries was at play, but we found no significant change in trade structure hinting at large-scale rerouting **(Chart 4)**. In 2023, China's share of electronic device imports declined across all three countries compared to 2019. Although Chinese device exports to those countries increased, their own exports to the US grew by a far bigger margin. Furthermore, product-level data for Vietnam (computers, smartphones, earphones), Taiwan and Mexico (computing equipment) match with qualitative information pointing to fast-growing assembly activities in those countries destined for companies including Apple, Samsung and HP, among others.

Chart 4 - Change in electronic device trade structure in selected countries

Indicator	Mexico	Taiwan	Vietnam
Change in China's share in electronic device imports, 2017-2023	-7.2pp	-8.8pp	-0.8pp
Change in Chinese electronic devices exports to those countries, 2017-2023, in USD billion	3.04	1.60	2.52
Change in US electronic device imports from those countries, 2017-2023, in USD billion	8.30	16.66	28.58

Sources: Comtrade, Coface

Owing to very substantial changes in market shares over large trade volumes, export losses and gains are macroeconomically significant. To quantify them, we compared the realised, cumulative electronics device exports to the US from China, Vietnam, Taiwan and Mexico against a scenario where their market shares would have held perfectly stable at their 2017 levels. We found that from 2018 to 2023, lost market shares cost China a cumulated USD 147 billion in exports to the benefit of Vietnam, Taiwan and Mexico, whose rising market shares generated USD 88 billion, USD 47 billion and USD 23 billion in export gains, respectively **(Chart 5)**.

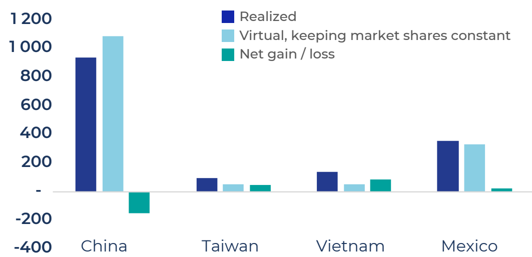
For all their merits, sanctions did not meet all their objectives

While headline trade figures show a dramatic shift in bilateral US-China electronics trade, other data point to a more nuanced impact when considering the objectives of the ongoing tech war. First, while tariffs were undeniably successful at curbing direct exports from China to the US, it is too early to say whether they have contributed to reduce underlying reliance on China. The same countries that captured the bulk of China's lost market share in the US since 2017 witnessed a surge in electronic component imports from China – +191% for Vietnam, +102% for Taiwan and +103% for Mexico – suggesting that Chinese suppliers have followed the electronics manufacturing services (EMS) companies which shifted production to those countries. Additionally, data from the OECD's trade in value-added database (TiVA) show that those countries' electronics exports incorporate a great deal of imported value-added – 34% for Taiwan, 48% for Vietnam and 70% for Mexico – and that China is their leading partner in terms of imported value-added. The case of Mexico, the US' manufacturing backyard and its second-largest sourcing partner for electronic devices, stands out: China alone provides 27% of the value-added incorporated in Mexican exports, which is twice the US contribution.

Second, tariffs have failed to address the trade deficit they were supposed to fix: the trade deficit for electronic devices jumped from USD 232 billion in 2017 to USD 275 billion in 2023, reaching record high levels during the pandemic. Increasing restrictions on Chinese exports created an opportunity that other countries seized to the detriment of the US domestic electronics industry. As a result, the sector's share in US industrial production continued its long-term decline, falling from 2.4% in 2017 to 2% in 2024. The economics of consumer electronics assembly, which is a labour-intensive, high-volume and low-margin business, does not make the case for a comeback on US territory anytime soon. In this respect, placing tariffs on electronics seems far more about encouraging import diversification or exerting political pressure than stimulating domestic production.

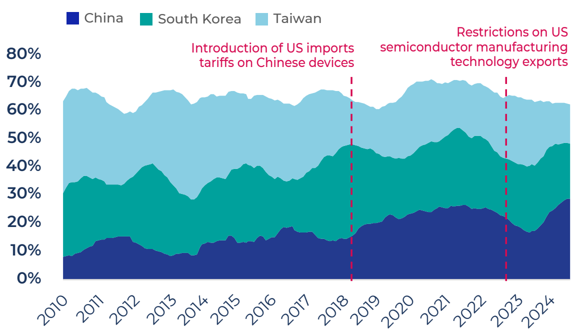
Third, export restrictions on advanced semiconductor manufacturing technology appear to have accelerated Chinese efforts to close its wide technology gap with the US, albeit through a more challenging path. The prospect of ever-growing restrictions on imports of US technologies has encouraged Chinese semiconductor foundries to frontload purchases of US equipment: since 2017, Chinese imports of US semiconductor manufacturing machinery have more than doubled, making China the top export market for US manufacturers ahead of South Korea and Taiwan **(Chart 6)**.

Chart 5 - Cumulative electronic device exports to the US, 2017-2023, realised vs. virtual using 2017 markets shares *(USD billion)*



Sources: USITC, Coface

Chart 6 - US exports of semiconductor manufacturing machinery and material by country of destination (%)



Sources: USITC, Coface

A similar development is noticeable in Chinese imports from Japan and the Netherlands, the two other leading providers of semiconductor manufacturing machinery. Reflecting the trend, China spent close to USD 25 billion in semiconductor manufacturing machinery purchases in H1 2024 – more than the US, Taiwan, South Korea and Japan combined.

The US Tech War: a policy push amidst corporate reluctance

The ties connecting the US and Chinese electronics industry have proven more resilient than what headline bilateral trade figures might suggest. We believe this has to do with the fact that the US administration's long-term drive to cut ties with China contradicts the short-term interests of corporate America and most dominant electronics companies in the world. The US electronics industry has in fact voiced its concerns ever since the US-China rivalry intensified, citing China's role as a critical supplier of inputs (rare earths), a major manufacturing hub and a large end market – or, putting it differently, as a major supplier and customer rather than a competitor.

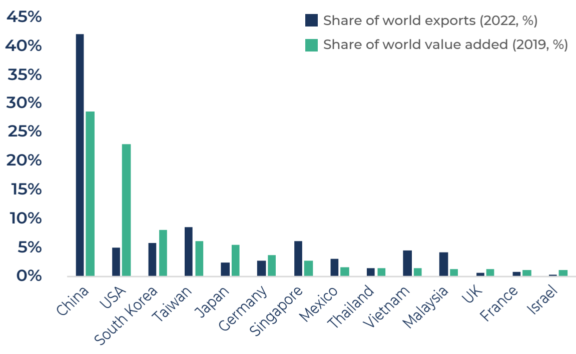
While trade figures are a good reflection of China's central role in electronics manufacturing, they tend to amplify the country's real contribution to profit generation in the industry. Alternative datasets, on the contrary, provide a more nuanced vision of trade relations and explain the reluctance of US firms to cut ties with China.

"Designed in California, Assembled in China" is the industry's paradigm

The wording on the back of many Apple products epitomises the configuration of the global electronics value chain of the past twenty years: the US electronics industry has largely focused on the most advanced and profitable segments of the value chain, while leaving less profitable or strategic activities to third-party companies and countries.

Plotting the share in world electronic exports against the share of electronics value-added for the industry's main players, we observe that manufacturing and trading hubs such as China, Singapore, Malaysia, Vietnam, Thailand and Mexico feature much less prominently when it comes to value-added. Conversely, the US and Europe, which are secondary exporters (17% combined) but major players in electronics R&D and design, still command a large share of value-added (36% vs. 29% for China) **(Chart 7)**.

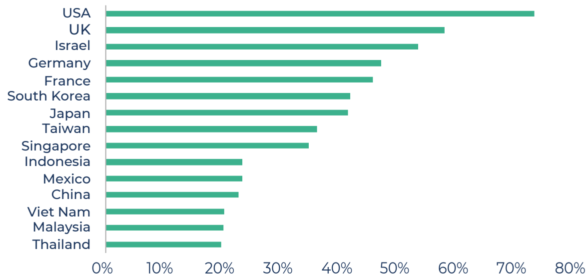
Chart 7 - Share of countries in world electronic exports and value-added (%)



Sources: Comtrade, OECD, Coface

The divide between generally higher and lower value-added activities is also noticeable when calculating value-added ratios: measuring value-added against turnover, we observe that European and US electronics companies extract considerably more value from the same dollar of activity than trade and manufacturing hubs **(Chart 8)**.

Chart 8 - Electronics value-added ratios of selected countries (value-added as % of turnover, 2019)



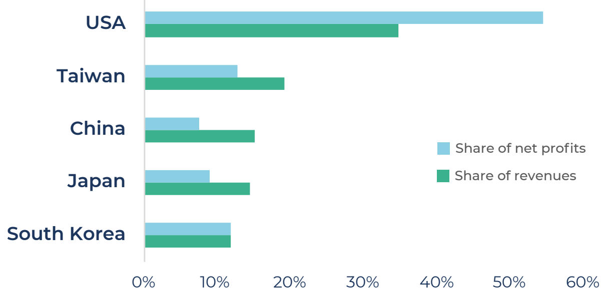
Sources: OECD, Coface

Ultimately, while China plays an outsized role in electronics manufacturing and trade, true value and profits in the global electronics industry are still largely concentrated in the US and in those countries aligned geopolitically with the US. While trade policies can shift production elsewhere, the intricate web of global supply chains and the reliance on China's scale and efficiency in manufacturing remain deeply embedded in the industry's structure.

Industry profits are overwhelmingly captured by US companies

This pattern of high value-added concentration in the US and US-aligned countries is also remarkable at the corporate level. To determine which countries dominate the main segments of the electronics value chain, we analysed the turnover and net profits of over 350 listed electronics companies[2] over a ten-year period, assigning them to countries based on the location of their headquarters and to specific value chain segments according to their activity codes, primary products, and business descriptions **(Chart 9)**. We found that, across all segments, US companies generated 35% of global revenues and 54% of global profits.

Chart 9 - Share of listed electronics companies in sales and profits by headquarter location in 2014-2023 (%)



Sources: LSEG Eikon, Coface

US firms in particular dominate the highly profitable segments of semiconductor manufacturing machinery and materials (44% of segment profits), fabless semiconductors (90%), integrated design manufacturers (75%), as well as the less profitable but large consumer electronics (62%) and business electronics (59%) segments

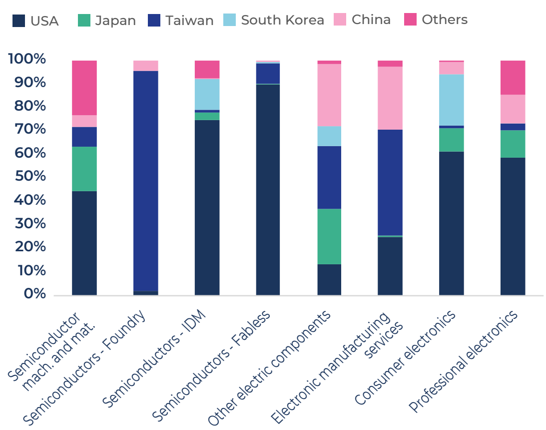
2 - To our knowledge, China's privately-owned Huawei (net turnover of USD 98 billion in 2023) is the only major dominant electronic company missing from our sample

(Chart 10). The only high value-added segment in which the US is missing is that of semiconductor foundries, a situation which was most certainly in US policymakers' minds when drafting the 2022 CHIPS and Science Act. While US companies currently trail their South Korean and Taiwanese competitors for advanced semiconductor manufacturing, this was not always the case. In the 2000s, several US vertically-integrated companies opted to divest from manufacturing in order to focus on design, not from a lack of capability, but rather owing to the intense cyclicality of the segment and the substantial capital investment required for semiconductor fabrication. Interestingly, South Korean, Taiwanese and Japanese companies face the same dilemma as their US counterparts regarding their relationship with China as they, too, are reaping substantial profits from the current organisation of global electronics value chains.

Industry leadership remains far beyond the grasp of Chinese companies

Another reason most US corporates are reluctantly cutting ties with China is that, unlike other sectors where China has become either a serious challenger (biotechnology, artificial intelligence) or is already the market leader (electric batteries, wind turbines, solar panels), Chinese firms operating in the electronic industry do not yet pose a major threat to US leadership. Looking at the same dataset, we find that Chinese firms have largely outperformed their peers in terms of growth – their cumulated sales have tripled in ten years vs. a 60% increase for the industry as a whole. In particular, Chinese companies hold sizeable shares in non-semiconductor electronic components (27% of industry revenue), professional electronics (21%), electronic manufacturing services (18%) and consumer electronics (14%), with companies including BOE Technology (screens), Xiaomi (smartphones) and TCL (TV sets), and have become household names in their respective businesses **(Chart 10)**.

Chart 10 - Breakdown of segment profits by country, 2014-2023 average (%)



Sources: LSEG Eikon, Coface

However, these segments are the least profitable, and arguably the least strategic, of the industry. Conversely, despite surging sales and remarkable technological progress, China has remained a tier-three player in semiconductor technologies, posting a share in global revenues that oscillates between 1% and 10% across the segments **(Chart 11)**. Factoring in the growing hurdles Chinese companies face to procure advanced foreign technologies and learn from them, the prospect of China competing on par with industry leaders on established semiconductor technologies remains distant.

What will electronics supply chains look like in the next decade?

Seven years into the tech war, the intricate connections between the US and Chinese electronics industries have demonstrated a resilience that surface-level trade data alone might not reveal. Both economies remain closely linked: China continues to be a key manufacturing base, supplier and market for US companies, while US firms dominate the most profitable parts of the value chain. The complexity of these global supply chains has so far maintained these ties, even as tariffs and sanctions intensify.

However, history shows that the electronics industry has undergone dramatic shifts before, often in unexpected ways. As tensions in US-China rivalry persist – and these will only exacerbate during Donald Trump's second term of office – deeper changes in the structure of global electronics supply chains are not only possible but may well unfold in the coming decade.

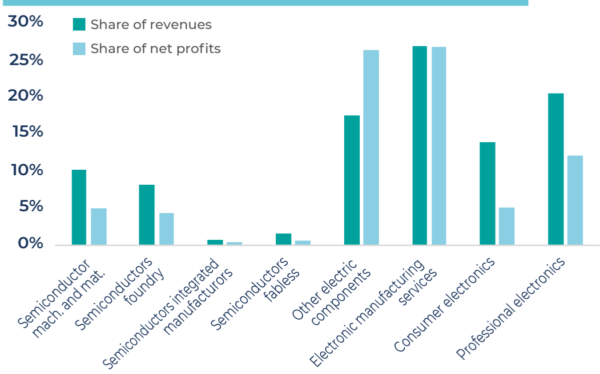
Silicon is not forever: lessons from past disruptions in the electronics industry

In previous decades, electronics supply chains seemed just as entrenched as they are today, yet shifts in market dynamics reveal at least two pivotal periods when established competitive positions were dramatically redefined.

One such shift occurred in the late 1980s and early 1990s when Japan controlled over half the global semiconductor market through vertically integrated companies like NEC, Fujitsu, Toshiba, and Sony which controlling everything from chips to portable audio players, mainframe computers and TV sets. However, when Japanese competition began to take a toll on US semiconductor companies the US responded by filing trade lawsuits. The 1986 Semiconductor Trade Agreement between the US and Japan ultimately helped restore the competitiveness of US semiconductor companies through a mix of higher import tariffs and controls over minimum prices.

At the same time, the personal computer market was expanding rapidly and would soon outpace traditional consumer electronics in scale and significance. Initially, US electronics companies benefited immensely from using the open IBM PC architecture as the global standard. Japanese companies, conversely, stuck to their business model of vertical integration and proprietary systems that greatly limited software and hardware compatibility – the model was less cost effective and was unable to incorporate third-party innovation. The near monopolies of Intel CPUs and Microsoft operating systems from the early 1990s further cemented the US' domination of the personal computer era. By the late 1990s, Japan's dominance in semiconductors had significantly declined as South Korean and Taiwanese competitors rose to prominence, and Japanese firms began exiting much of the consumer electronics business due to increasing competition from China.

Chart 11 - Share of listed Chinese companies in global sales and profits by segment, 2014-2023 average (%)



Sources: LSEG Eikon, Coface

Twenty years later, the launch of the Apple iPhone in 2007 triggered another major overhaul of the electronics industry's market shares. Similar to the surge in computer shipments from 1990 to 2005, global smartphone sales soared from 150 million units in 2007 to 1 billion in 2013, making smartphones the largest market for semiconductors. The shift prompted many former European and North American industry leaders, including Nokia, Ericsson, Motorola, and BlackBerry to ultimately exit the market, along with many of their suppliers. At the same time, the smartphone boom benefited key component makers, particularly South Korean firms such as Samsung and SK Hynix (for memory chips), Taiwanese companies like TSMC (contract chip manufacturing), and US firms such as Qualcomm and Broadcom (processors and telecom chips). Unlike feature phone manufacturers that retained some in-house production, Apple and its US suppliers outsourced most manufacturing to third party companies in the Asia-Pacific region, and particularly in China which had joined the World Trade Organisation only a few years earlier.

Both the personal computer revolution of the 1990s and the smartphone boom of the 2000s demonstrate that, despite seemingly entrenched market dominance, proven business models and well-established supply chains, disruptive innovation and shifts in the global trade environment can rapidly realign industry leadership, with new regions and companies emerging as key players in the global electronics landscape.

Chart 12 - Changes in the innovation and trade environment and their possible outcomes over the next decade

Source: Coface

Heading towards a Tech Stalemate or a Tech Rift in the coming decade?

To assess potential outcomes for the industry over the next decade, we have considered the same two forces that have historically reshaped the electronics landscape – major shifts in the global trade environment and the disruptive potential of innovation-driven shakeouts.

Possible catalysts for accelerated shifts in the global trade environment could include a high-profile national security incident in China or the US involving technology from the other country, blanket US technology export restrictions that target all Chinese companies, the weaponisation of rare earths by China leading to a lasting freeze in critical mineral exports or military flashpoints directly involving the US and China. Triggers for disruptive innovation are, by definition, less likely to be foreseen but could include a breakthrough in quantum computing that changes the face of computing equipment, a leapfrog in semiconductor manufacturing technologies (material, process, chip architecture) that would help China close the technology gap or the rise of artificial intelligence as a proven and profitable boost to productivity across the entire economy.

By mapping assumptions on the possibility of accelerating changes in the global trade environment and disruptive innovation, we have outlined four distinct scenarios **(Chart 12)** ranging from the least to the most transformative: **Tech Stalemate, Tech Cold War, Tech Race, and Tech Rift.** Each scenario, in turn, impacts:

TRADE COMPLEXITY
greater supply chain fragmentation, a shift in standards, and trade restrictions that affect how components are sourced, made or distributed would translate into generally higher operating costs and longer cash cycles.

TRADE VOLUMES
disruptive innovation would stimulate overall industry growth, but would also make existing technologies obsolescent. Trade restrictions would reduce the size of the addressable market, i.e., the market companies can access taking into account the existing restrictions.

VOLATILITY
changes in the trade and competitive environment could reallocate existing market shares between countries and companies and, if they are fast-paced, create supply chain tensions.

SCENARIO 1
TECH STALEMATE

In this scenario, the rivalry between the US and China stabilises and no major disruptive technology emerges to reshape the industry.

Trade complexity increases moderately as tariffs and sanctions remain in place, yet global supply chains avoid widespread fragmentation. Trade volumes grow steadily, driven by consistent demand for electronics across the various sectors.

Country and company market shares maintain their current trend in which the US still claims technological and profitability leadership, but where China slowly catches up.

SCENARIO 2
TECH COLD WAR

In the **Tech Cold War scenario**, the rivalry between the US and China intensifies, with both sides implementing more aggressive trade restrictions and sanctions, and both targeting the other's critical vulnerabilities.

Although no new disruptive technology emerges, the geopolitical divide gradually gives way to two increasingly distinct technological ecosystems which force non-US companies and third-party countries to develop different products and services tailored for the US or China, when not forbidden to serve both.

Trade complexity rises significantly as supply chains fragment, change and operate under different sets of standards, regulations and restrictions. Trade volumes experience moderate growth within blocks, but the global addressable market shrinks.

The vacuum created by Chinese companies that lose ground in the US and by US companies that retreat in China reshuffles the market shares of companies operating locally.

SCENARIO 3
TECH RACE

In the **Tech Race scenario**, rivalry between the US and China remains at current levels, but a new disruptive technology emerges.

Given their massive investment in next generation technologies, China and the US are well placed in the race and develop parallel ecosystems to better exploit the new technology without fully severing trade relationships.

Trade complexity increases as companies and countries compete for dominance, but the competition remains focused on innovation rather than political confrontation.

Trade volumes experience significant growth, driven by demand for the new technology and its related products. Market share volatility rises as rapid gains emerge for those companies and countries which successfully capitalise on the new technology, while others struggle to keep pace.

SCENARIO 4
TECH RIFT

In the **Tech Rift scenario**, the rivalry between the US and China escalates significantly as a new disruptive technology emerges.

This dual force triggers an all-out change in global supply chains, standards and markets, resulting in two increasingly separate ecosystems – one dominated by the US and its allies, the other by China.

The disruptive technology intensifies competition, forcing countries and companies to choose sides. Trade complexity soars as firms are forced to adapt to a different trade and competitive environment.

Trade volumes grow, but only within these separate ecosystems, while cross-border flows between the US and China shrink dramatically. Market share volatility skyrockets as the global electronics landscape undergoes a shake-up – one that produces new leaders in each ecosystem while previously dominant players struggle to keep their heads above water.

Coping, adapting and transforming to navigate possible industry disruptions

To understand how companies and countries might respond to these potential futures, we have applied a Cope, Adapt, Transformative Adaptation (CAT) framework inspired by resilience theory that is also used in organisational strategy and sustainability. It identifies three stages of response to disruptions based on their magnitude and time horizon: coping (short-term stabilisation), adapting (medium-term adjustments) and transforming (long-term structural change) which guide decision-making in dynamic environments. While adapting may be enough for countries to retain their market shares in the most benign scenario of a Tech Stalemate, the Tech Race and Tech Rift scenarios would require more transformative actions. In the following table, we have set out the typical coping, adapting and transforming measures for the five main groupings operating in the electronics industry – the US, US-aligned technological leaders (Japan, South Korea, Taiwan), emerging manufacturing hubs (Vietnam, Mexico, etc.), China and Europe **(Chart 13)**. Looking across the regions and measures, we have identified both common topics and major differences.

Overall, we see that costs, whether supported by governments or private companies, increase dramatically owing to duplications, operational complexity, higher inventory buffers for critical inputs and reduced economies of scale. While hard to quantify, the cost for less integrated value chains will be significant. Considering the industry from a global point of view, the technology war is a negative sum game.

Yet not everyone will lose out and emerging manufacturing hubs have arguably the highest chances to benefit from trade fragmentation by capturing China's lost market shares. Innovation will, again, be a decisive for the future of an industry that emerged less than eighty years ago with the invention of the transistor. Countries with the most innovative technology ecosystems (public, private, academia) will doubtless be the best placed, if not to invent, then at least to provide a significant contribution to the next big thing.

While Europe and the US will doubtless strive to reduce their direct and indirect dependence on China, the sheer size of China's economy, population, and landmass is likely to limit how much that exposure can

Chart 13 - Possible coping, adapting and transforming measures for the five main groupings operating in the electronics industry

	Coping	Adapting	Transforming
US	**Fine-tune trade policies and their enforcement** to balance security, influence and technological leadership with the short-term interests of US corporates	**Address critical vulnerabilities** along the value chain to reduce China's leverage (e.g. rare earths) **Align corporate and national interests** by incentivizing domestic production of highly strategic, but less profitable, components and devices – broadening of the Chips Act to a wider range of chips **Consider including trade restrictions based on foreign content intensity**, rather than country of origin to reduce underlying reliance on China **Improve coordination with US-aligned technology leaders** to encourage a common stance vs China and avoid leakages	**Fully decouple components manufacturing and device assembly** from China by funding and supporting manufacturing investment in allied countries **Enter an alliance with US-aligned technology leaders** to jointly define future standards aligning with shared interests and value in critical technologies (AI, 6G mobile networks, etc.) **Maintain technological and economic leadership** in the industry by finding out "the next big thing"
US-aligned technology leaders (South Korea, Taiwan, Japan)	**Maintain dual supply chains** to comply with US restrictions on advanced technologies while keeping legacy businesses running **Defend respective, well-established niches** to resist China's growing competitiveness	**Develop a dual production approach** to comply with both Chinese and US standards and restrictions **Regionalize production** in Europe and the US to reduce exposure of local activities to China-US tensions **Build-up strategic inventories and design back-up plans** to prepare for possible disruptions	**Fully decouple components manufacturing and device assembly** from China by following electronics devices designers and assemblers in new electronics manufacturing hubs **Enter an alliance with the US** to jointly define future standards aligning with shared interests and value in critical technologies (AI, 6G mobile networks, etc.)
Emerging manufacturing hubs (emerging Asia, Mexico)	**Increase manufacturing capacity:** Continue benefiting from US and Chinese supply chain shifts by attracting investment in electronics manufacturing services (EMS) and lower-tier component production. **Safeguard relative trade neutrality:** Maintain trade relationships with both China and the US, avoiding aligning too strongly with either party.	**Attract foreign investment by offering incentives** (tax breaks) to multinational companies seeking to diversify away from China. **Invest in supporting infrastructure** (power, transport in particular) to prepare for booming trade **Move up the value chain** to capture a share of lower value components formerly captured by China	**Build a profitable niche:** replicate the success of other Asian countries (South Korea, Taiwan, Japan, but also Singapore and Malaysia)
Europe	**Safeguard trade interests:** Europe must walk a tight line with China owing to the strong exposure of its industries (automotive, chemistry, machinery, luxury) to the Chinese market. Head-to-head confrontation with China would be risky/ **Build-up strategic inventories and design back-up plans** to prepare for possible disruptions	**Align corporate and national interests** by incentivizing regional production of chips critical to the local industries (automotive, machinery, etc.) – going further than the European Chips Act **Attract foreign technology leaders in Europe** to increase domestic reliance	**Play the long game** as Europe is way too late to challenge the strongholds built by the US and US-aligned technology leaders in semiconductors. Public support should focus more on competitiveness in next generation technologies than plugging a gap that has become too wide. **Enter an alliance with the US** to jointly define future standards aligning with shared interests and value in critical technologies (AI, 6G mobile networks, etc.)
China	**Secure as much advanced foreign equipment as possible** before US restrictions on technology exports further escalate **Stimulate domestic adoption of IT** to compensate for the loss of export markets **Expand global influence** to maintain good trade relationships with non-aligned countries	**Expand semiconductor self-reliance** – replacing imports with domestic production would already provide a substantial boost to domestic activity and improve trade balance **Leverage control over critical assets (rare earths)** to deter additional trade restrictions	**Compete in the standards race** in future technologies to secure access to non-aligned markets **Develop homegrown manufacturing technologies** in semiconductors **Gain technological and economic leadership** in the industry by finding out "the next big thing"

Source: Coface

realistically be minimised. Similarly, US and Chinese efforts to reinforce their autonomy will most certainly hit a ceiling – the industry is too complex and the remarkable niche positions of some countries and companies are too firmly established for any one country to claim control over the entire electronics value chain.

In this respect, regional or international cooperation will play a large role in shaping the chances of China and the US to reach their respective goals over the next decade. For instance, a decision by Europe to take sides with the US against China would considerably boost US efforts. Yet, all in all, Europe seems the most at risk of losing ground in international competition for two reasons. First, the Old Continent lacks the strong and strategic momentum of a central government typical of China and the US. Second, Europe has also until now refused to specialise in a given part of the value chain, contrary to Taiwan, South Korea, Japan, Singapore or even Malaysia and Israel.

Bracing for impact: assessing the industry segments' strengths and weaknesses

To assess the vulnerability to shocks of the various segments making up the electronics industry, we have calculated at company level eight ratios reflecting the critical dimensions of business risk: growth, profitability, capital intensity, innovation intensity and cash cycle length over a five-year period that captures a whole cycle, as well as liquidity, financial leverage and interest coverage which, using the most recent data, are more volatile **(see Box 1 for our methodology)**.

We then assigned companies to nine industry segments and calculated median values for each segment on each dimension. We subsequently ranked segments from one to nine on all dimensions and summed their rankings to obtain an overall score. Segments with the lowest scores are comparatively the safest, while segments with the highest scores are comparatively the riskiest **(Table 14).**
We found that segment risk scores were broadly distributed from 22 to 52 on a possible scale ranging from 9 to 72, which indicates that the risk profiles are significantly patchy. Overall, the upstream part of the industry (semiconductors and components) looks structurally less vulnerable. It boasts the highest profit margins, reflecting both high value-added products and generally oligopolistic, if not monopolistic, product markets, which translates into excellent credit metrics. Its main weaknesses are its comparatively high capital intensity, which generates high fixed costs that seriously erode profitability when demand recedes, and long cash cycles reflecting scattered value chains from suppliers to customers.

Box 1 - Risk scorecard methodology

To calculate industry metrics, we used an unbalanced panel of 362 listed companies with annual turnover exceeding USD 1 billion (401 including electronics wholesalers).

- **Country allocation is based on the location of the company's reported headquarters.**
- **Segment allocation is primarily determined by reported activity codes as per the Global Industry Classification System (GICS). Additionally, we incorporated reported business descriptions and, where possible, sales breakdowns by activity for diversified groups.**
- **When calculating aggregate industry sales, profits, and growth, financials were converted into USD using current exchange rates. The size of the sample grew by 8% over the observed period, reflecting the IPOs of emerging companies and the industry's growth dynamics.**
- **When calculating ratios for our risk scorecard, financials were retained in the company's domestic currency. Companies with negative equity were assigned a net debt to equity ratio of 5, and companies with negative EBITDA were assigned an EBITDA to net interest expense coverage ratio of -5. For companies with a positive net interest expense balance (i.e., positive interest earned versus interest due), the net interest expense coverage ratio was set to their segment average. The reporting rate was 100% for all ratios except growth (97%, reflecting the increase in the sample size over time) and R&D spending (82%). Groups not disclosing R&D spending (EMS and wholesalers) were assigned a ratio of 0.**

Table 14 - Relative risk assessment of segments in the electronics industry
(segment rank across different risk dimensions, 1=best, 9=worst)

Segments*	Growth	EBITDA	CAPEX	R&D	Quick ratio	Cash cycle	Net debt/ equity	EBITDA/ interest expense	Total risk score
Semiconductors - fabless	1	4	5	1	1	4	4	4	22
Semiconductor equipment and materials	2	3	7	6	3	9	3	1	34
Semiconductors - foundry	7	1	9	3	2	6	1	5	34
Other electronic components	5	5	6	7	4	5	6	2	40
Semiconductors - IDM	4	2	8	2	5	8	7	6	42
Consumer electronics	8	7	4	5	8	3	5	3	43
Professional electronics	6	6	3	4	6	7	4	7	43
Wholesalers	3	9	1	9	9	1	9	9	50
EMS	9	8	2	8	7	2	8	8	52

Sources: LSEG Eikon, Coface. *See the appendix for the definition of segments

The consumer electronics and professional electronics segments appear comparatively riskier, squeezed between semiconductor companies with considerable market power, moderate growth in sales volumes – most large electronic device product markets including smartphones and computers are now very mature – and fierce competition led notably by Chinese companies. Because they generally manufacture neither electronic components nor electronic devices, their business models are comparatively less cash-intensive and easier to adapt to sudden downturn periods.

Wholesalers and electronics manufacturing services companies have the lowest profit margins and credit metrics, but also the least capital-intensive business models and the shortest cash cycles, pointing to their capacity to adapt to lower demand and preserve their profit margins.

While we argue that our scorecard provides an accurate assessment of the relative risk across electronics industry segments, it will ultimately be the precise nature of the changes shaping the industry over the next decade that will determine the magnitude of their impact on the segments.

CONCLUSION

The era of seamless, globally integrated operations is shifting toward one where electronics companies and countries must actively manage dependencies and remain agile to withstand geopolitical and economic pressures. The stakes are particularly high for US corporates, which benefited from the majority of industry profits under the previous open trade paradigm, and for their Chinese competitors, whose rapid advancements have doubtless intensified US concerns over rivalry. Caught in the crossfire, Japan, South Korea, Taiwan, Europe and emerging manufacturing countries will have to perform a delicate balancing act to best defend their respective economic and geopolitical interests.

Regardless of the exact scenario for the next ten years, electronics companies will have to cope with heightened risks of supply chain disruptions, foreign market access restrictions, geopolitical compliance pressures, diverging standards and investment constraints – all of which will play a part in fuelling volatility in an already cyclical industry and add a significant cost burden.

Companies would be well-advised to pursue proactive supply chain diversification, devise contingency plans, empower regional subsidiaries with greater decision-making autonomy and flexibility, and reinforce risk management and compliance functions to enhance resilience and responsiveness within increasingly complex and localised trade environments.

Policymakers must keep in mind that breakneck US-China technology rivalry is now a defining feature of the industry and that not everyone will emerge a winner of this competition. If electronics is to the digital economy what oil is to energy, then this industry deserves heightened attention and strategic prioritisation to ensure greater self-sufficiency when it is possible and international cooperation between allied countries when it is not.

APPENDIX

Scope of the report

The electronics industry encompasses a wide range of activities related to the research, development, and manufacturing of electronic components and devices. The key segments covered in this report are as follows:

Semiconductor Equipment and Materials:
this segment includes companies that supply specialised machinery, tools, raw materials, and chemicals needed for semiconductor production, supporting every stage from wafer fabrication to packaging and testing.

Semiconductor Foundry:
foundries are specialised manufacturers that produce chips designed by other companies, such as fabless firms, using advanced equipment and materials.

Semiconductors - Fabless:
fabless companies focus on designing and developing semiconductor chips but outsource the manufacturing process to foundries, avoiding the heavy investment required to build and maintain their own fabrication facilities.

Semiconductors - IDM (Integrated Device Manufacturers):
IDMs design and manufacture their own semiconductors, although they may also outsource some production to foundries for certain chips.

Other Electronic Components:
this segment covers a variety of non-semiconductor electronic parts, such as capacitors, resistors, and connectors which are essential to the functioning of electronic devices.

EMS (Electronics Manufacturing Services):
EMS providers specialise in assembling electronic components into finished devices for other companies, typically working with consumer and professional electronics firms.

Consumer Electronics:
companies in this segment design electronics for everyday use, such as smartphones, televisions, and computers, and generally outsource the assembly to EMS providers.

Professional Electronics:
This segment focuses on specialised electronic devices, often catering to corporate and industrial clients, including telecom and network equipment.

Wholesalers:
Wholesalers act as intermediaries, purchasing electronic components and devices in bulk and distributing them to retailers and other businesses.

Mapping of product codes, sub-segments and segments used for trade calculations

Product code	Description	Sub-segment	Segment
8532	Electrical capacitors, fixed, variable, or adjustable (pre-set).	Other electronic component	Electronic components
8533	Electrical resistors, including rheostats and potentiometers, other than heating resistors		
8534	Printed circuits, without elements other than connecting elements.		
8541	Diodes, transistors, and similar semiconductor devices; photosensitive semiconductor devices, including photovoltaic cells whether or not assembled in modules or made up into panels; light-emitting diodes; mounted piezo-electric crystals	Semiconductors	
8542	Electronic integrated circuits; parts thereof		
8518	Microphones and stands therefor (excluding cordless microphones)	Audio and video equipment	Electronic devices
8519	Sound recording or sound reproducing apparatus		
8520	Magnetic tape recorders and other sound recording apparatus		
8521	Video recording or reproducing apparatus, whether or not incorporating a video tuner		
8522	Parts and accessories suitable for use solely or principally with the apparatus of headings 8519 to 8521		
8524	Records, tapes and other recorded media for sound or other similar phenomena		
8525	Transmission apparatus for radio broadcasting or television		
8527	Reception apparatus for radio broadcasting, whether or not combined with sound recording or reproducing apparatus		
8528	Monitors and projectors, not incorporating television reception apparatus		
8471	Automatic data-processing machines and units thereof; magnetic or optical readers, machines for transcribing data onto data media in coded form and machines for processing such data, not elsewhere specified or included	Computing equipment	
8517	Telephone sets	Telecommunications equipment	
381800	Chemical elements and compounds doped for use in electronics, in the form of discs, wafers, or similar forms; chemical compounds doped for electronic use	Semiconductor material	Semiconductor machinery and material
844250	Plates, cylinders, and other printing components; plates, cylinders, and lithographic stones, prepared for printing purposes	Semiconductor machinery	
848610	Machines and apparatus for the manufacture of boules or wafers		
848620	Machines and apparatus for the manufacture of semiconductor devices or electronic integrated circuits		
848690	Parts and accessories for machines and apparatus of a kind used solely -or principally for the manufacture of semiconductor boules or wafers, semiconductor devices, electronic integrated circuits or flat panel displays		
903141	Optical instruments and appliances for inspecting semiconductor wafers or devices or for inspecting photomasks or reticles used in manufacturing semiconductor devices		
8533	Electrical resistors, including rheostats and potentiometers, other than heating resistors		

Sources: Comtrade, Coface

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