

THE SEMICONDUCTOR WORLD

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The semiconductor industry is seen as the driving force of technological progress and has a significant impact on the economy and society. From an investor's standpoint, it is worth taking an in-depth and critical look at the complex and extensively interconnected value chain.

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Complex value chain

The semiconductor industry is the backbone of our modern, networked world. Whether they are in smartphones, computers or a simple washing machine, chips have become an integral part of most of our everyday appliances.

Further advances and miniaturisation have made chip production an enormously more complex process. This is evident in the massively increased demands on the specific production processes and the materials used.

The past few decades have seen the evolution of a global and extensively interconnected value chain, underpinned by highly innovative and specialised companies which are driving forward the production of ever more powerful chips. Below we will describe the key elements and characteristics of this value chain and explain the aspects that need to be considered from an investor's perspective.

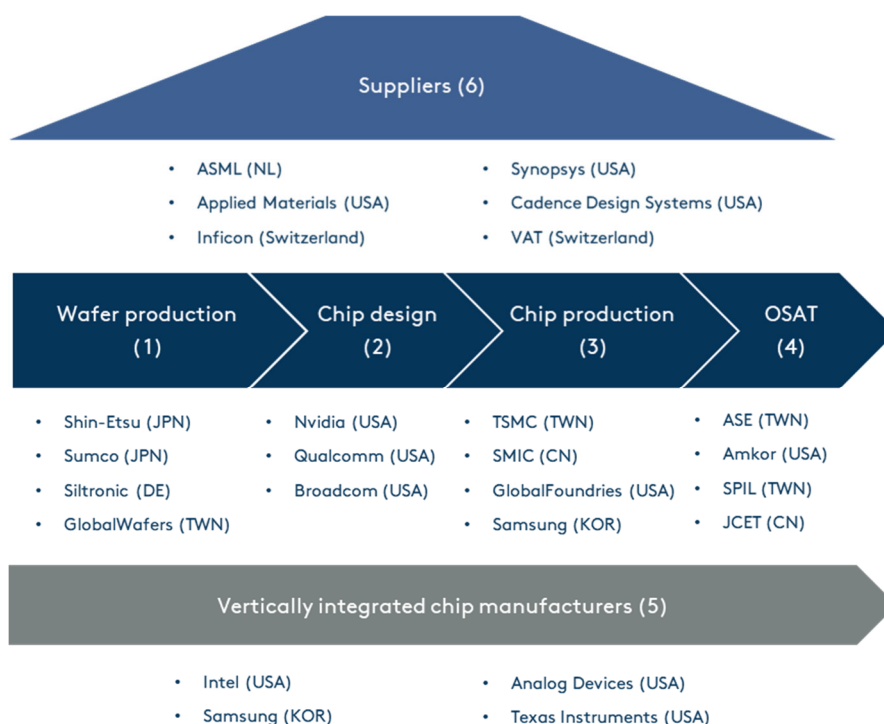
The key stages in the process

Chips are masterpieces of technology. Figure 1 shows the various stages of the value chain, together with globally significant companies.

Wafer production (1) is the starting point for manufacturing a chip. This process begins with the melting of quartz sand into a cylindrical structure. Thin discs are sawn from this, which are then sanded and finished. Less than 1 millimetre thick, these discs, known as wafers, are the basis from which the chips are ultimately manufactured.

Before the actual chip production process can begin, a blueprint – called the chip design (2) – is needed as the chip must fulfil different requirements depending on its future application. Basically, the challenge in the design process is to develop chips with the maximum possible performance, low power consumption, on the smallest possible surface area and at the lowest possible cost.

Fig. 1: The semiconductor industry at a glance



Dedicated software is used to meet this challenge. With it, chip design engineers create a virtual structure of the chip to be produced. Before this blueprint comprising billions of transistors is effectively put into production, it undergoes extensive testing. This is also done virtually, i.e. using simulation software. This test phase is extremely important: if the architecture of the chip is faulty, it can no longer be corrected in the later, costly production steps. Faulty chips cannot be repaired.

When the design phase is completed, actual chip production (3) can begin by creating the chips on the coated wafers. Depending on the complexity of the chips, hundreds of individual process steps are needed for the completion. After production, the chips must be tested for their functions and prepared so they can be installed in the end devices. Chip manufacturers do not usually handle this part of the value chain, which is instead outsourced to specialised companies. These companies make up the category OSAT (4) (Outsourced Semiconductor Assembly and Test). Once this process step is completed, the chips are ready to be shipped and are then delivered to manufacturers of end devices such as smartphones, cars and washing machines.

All companies are continually faced with the fundamental dilemma: should we outsource or do it ourselves?

Which activities and process steps should we carry out ourselves? And which parts of the value chain should we source from partner companies and suppliers instead? In many cases, the arguments in favour of focusing on core competencies prevail. This also applies to the semiconductor industry. The outcome is the emergence of numerous companies and industrial groups across the world which concentrate on individual process steps and, through research and development, push forward the boundaries of what is technically possible step by step. This universe of companies also includes the suppliers (6). Although they are not directly involved in chip production, they supply the necessary materials and tools. These also include some Swiss companies, as we will show later.

But some companies still handle a significant portion of chip manufacturing on their own. These are called vertically integrated chip manufacturers (5).

The US chip pioneer Intel is a very well-known example of this. But it's hardly surprising that this company has come under severe pressure in recent years and been forced to make drastic changes to its strategic orientation. The pace of technological progress and changing needs of customers are piling on enormous pressure. Lean, focused companies are generally in a better position to meet this challenge.

An industry with challenging characteristics

From an investor's standpoint, the semiconductor sector offers some very attractive characteristics with its "system-critical" function and the large number of fast-growing, innovative companies. But as with all industries and associated business models, it's also important to consider the challenging aspects here:

Technological change

The technological progress being made is immense, so the current state of technology can quickly become outdated and obsolete. Consequently, the pursuit of technological dominance is often accompanied by frequent changes in leadership. Market-leading companies should therefore never be too confident about remaining dominant.

Strong cycles

The sector experiences strong boom phases followed by no less severe (but distinctly shorter) downturns. This means that sales, profits and the business outlook of companies in the chip sector can be volatile. Forecasts should therefore be treated with maximum caution.

Fig. 2: The cycles of the semiconductor industry



Source: World Semiconductor Trade Statistics, own calculations

Geopolitics

Semiconductors have emerged as a crucial geopolitical factor. The industry is characterised by sanctions, restrictions and extensive subsidy programmes. The risks of unforeseeable political intervention adversely affecting a company's success are therefore high.

Attractive business models along the value chain

It's often the large and globally recognised companies which attract the attention of the media and investors with their end products. For it's the latest generations of mobile phones or graphics cards which allows us to grasp and utilise the huge progress of the semiconductor industry.

But from an investor's standpoint, these companies may not be the preferred option either, as they are often the most vulnerable to the specific characteristics of the semiconductor sector described above. For a cautionary tale from the past, we would like to remind our readers of the Finnish company Nokia. Its dominant market position in the mobile devices market quickly evaporated with the emergence of the first smartphones, with serious consequences for the shareholders.

More stable and predictable business models are often found in the upstream areas of a value chain. Investor and publicist André Kostolany very aptly put it this way:

"In a gold rush, don't invest in the gold diggers, but in shovels." – André Kostolany

Below we will be giving examples of companies that can circumvent or at least reduce the challenging industry characteristics described above (cyclicality, change and geopolitics).

EDA: software for chip design

Chip design calls for highly specialised software. The industry which specialises in the production of this software is called EDA or Electronic Design Automation. The EDA market is dominated by just three companies: Synopsys (United States), Cadence Design Systems (United States) and Mentor (subsidiary of Siemens). These specialised suppliers have the relevant chip design companies as their

customers and have become indispensable development partners.

EDA companies are increasingly selling their software in the form of multi-year service contracts, enabling them to generate steady and predictable income. Another positive aspect is the fact that software can be duplicated with no or very low marginal costs. EDA companies are therefore an attractive option with stable, growing earnings and an appealing return on capital employed.

Fig. 3: Strong growth in the EDA industry

	CAGR 2012 - 2022		
	Revenues	EBIT	ROCE
Cadence Design Systems	10%	19%	70%
Synopsys	11%	20%	20%

ROCE: return on capital employed
Source: Bloomberg, own calculations

Attractive equipment manufacturers

As explained at the beginning, actually producing chips is a highly complex and capital-intensive process. Companies such as Samsung (South Korea), TSMC (Taiwan) and GlobalFoundries (United States) have built up market-leading positions here.

To return to André Kostolany's quote: these "gold diggers" need stable, reliable "shovels" to be able to produce the chips without any faults.

ASML: undisputed top dog

Netherlands-based ASML produces lithography machines, which are needed to manufacture the most technologically advanced chips. ASML currently enjoys undisputed market dominance: without ASML's machinery it would be impossible to produce the latest generations of chips. Most industry experts believe that the company will be able to preserve its technological lead for many years to come.

So ASML benefits directly from the long-term increase in demand for semiconductors. It is, however, also fully exposed to the industry's strong cycles. The current situation is a prime example of this. Following the "coronavirus boom", chip manufacturers have been grappling with low utilisation of their facilities and have little motivation to invest

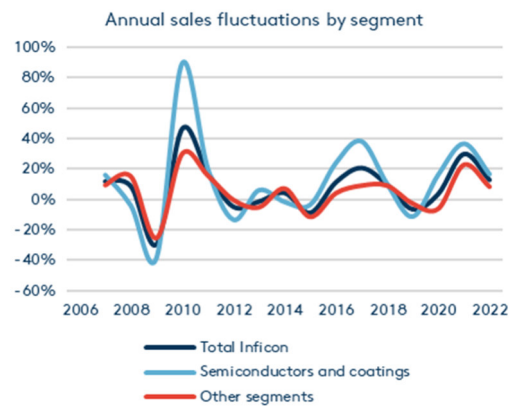
in expanding their capacities. ASML is experiencing this through a sharp decline in incoming orders.

Not surprisingly, ASML is also heavily exposed to the geopolitical tensions between the United States and China. The company is currently banned from selling its latest machinery to Chinese customers. A further escalation in the situation could have an additional negative impact on ASML's business in the short term. But from a long-term perspective, the geopolitical aspects appear less dramatic. Europe and the United States are endeavouring to diversify chip production (3) geographically, primarily to reduce their dependence on Taiwan. In combination with the structurally growing demand for chips, this offers promising prospects for consistently high demand for ASML's indispensable machines.

Inficon: the measurement specialist

Dominance like ASML's is relatively rare. But the extensively interconnected semiconductor value chain offers countless opportunities for a company to evolve into a specialised technology leader. With around 1,500 employees across three continents and sales of around CHF 600 million, Inficon is an excellent example of this type of Swiss niche specialist. To avoid contamination, individual manufacturing steps in chip production are carried out under vacuum conditions. Inficon's devices are used to measure and control these vacuum environments. The company invests around 8-10% of its annual revenue in research and development. Process and product improvements are frequently driven forward through close cooperation with customers. The result is increased customer loyalty, not least of all because of the higher potential switching costs. Besides the semiconductor industry (accounting for around 50% of sales), Inficon also serves other sectors and has several leading positions in technology. For example, the company generates strong sales with devices for battery testing and is therefore able to benefit from the structural growth of electromobility. This diversification on the customer side, coupled with an almost debt-free balance sheet, ensures it has the necessary stability to successfully weather the cyclicality of the semiconductor industry.

Fig. 4: Diversified Inficon



Source: Annual reports, own calculations

Conclusion

With its tremendous innovativeness, the semiconductor industry is one of the key and most influential factors in the global economy. Thanks to increasingly smaller and more powerful chips, digitalisation has rapidly and intensively pervaded almost every aspect of modern life.

Technological changes which are difficult to predict will continue to shape the industry in the coming years and lead to pronounced cycles. Geopolitical aspects will also have a strong impact on development. From an investor's standpoint, the semiconductor industry therefore has characteristics which call for a high level of caution.

But with an in-depth look at the entire value chain, it is always possible to identify companies which know how to position themselves promisingly in this challenging environment. The shares of these quality companies offer attractive opportunities for long-term risk-averse investors to participate in the promising growth and value creation potential of this key sector.

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