

MSIS 2604: INFORMATION SYSTEMS POLICY & STRATEGY

(SPRING QUARTER 2019)



A STUDY ON MICROCHIP TECHNOLOGY INC.

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03/19/2019

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ACKNOWLEDGEMENT

The success and outcome of this project required a lot of guidance and assistance from many sources and we are extremely privileged to have received this throughout the course of our project. We are grateful for the supervision and assistance, and we offer our sincere thanks.

We thank our professor, Dr. Darrel A. (Del) Mank for providing us an opportunity to complete this project and guiding us at every stage of this project.

We owe deep gratitude to our business librarian Mr. Anthony Raymond, for taking a keen interest in our project work and providing invaluable assistance.

We would also like to acknowledge Microchip Technology Inc., website (www.microchip.com) and SEC database (EDGAR Tool: <https://www.sec.gov/edgar/searchedgar/webusers.htm>) for providing the latest annual reports (Form 10K filings) , and other critical information.

EXECUTIVE SUMMARY

After accounting for splits, Microchip stock rose from \$0.50 in 1993 to \$100 in 2018 and predicted to go even higher by analysts. Clearly Microchip must be doing something right in a highly competitive environment, an industry used to very high growth rate which has now dwindled to low single digits.

Since 1993, Microchip understood importance of organic growth in the core business. While Moore's law played out nicely, Microchip did not squander away this advantage, and used it to cement its position using architectural control and sustained R&D. Microchip used propriety AVR and PIC architecture to make it difficult for customers to switch later. This brings us to learning #1, always differentiate yourself from competitors and prevent your products from being commoditized.

However, as it became more difficult/expensive to go to new technology-nodes and processes, growth rate of this industry rapidly slowed down, and industry went into a consolidation phase. Microchip switched gears and recognized that inorganic growth was just as important as organic growth. This brings us to learning #2, acquire or be acquired. Microchip has strategically acquired ~18 companies in last decade including 2 high profile/value companies recently. This enabled Microchip to acquire new technologies, patents, IPs, distributors and customers. As a result, Microchip debt is critically high, making it unattractive to be acquired and exposes it to financial risks.

Learning #3, Microchip could grow organically and inorganically only because of its vast distributor and supplier network with robust supply chain management.

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INDUSTRY OVERVIEW

The semiconductor industry lives and dies by a simple creed: smaller, faster and cheaper. Smaller the size of transistors, the faster is the chip, and a greater number of transistors can be placed on the chip making it cost effective. Increasing competition and newer technologies lower the average selling price. There is constant pressure to come up with something better and cheaper than what was defined as state-of-the-art only a few months before. Even in a down cycle, weak sales are seen as poor excuses for not coming up with better products to meet demands of customers wanting to upgrade their electronic devices. Traditionally, semiconductor companies controlled the entire production process, from design to manufacture. Yet many chip makers are now delegating more production to others in the industry. Chip companies are emerging leaner and more efficient¹.

INDUSTRY COMPETITOR ANALYSIS

The global microcontroller market is characterized by the presence of many vendors such as Microchip Technology, Infineon Technologies, Cypress Semiconductor, STMicroelectronics, NXP Semiconductors, Texas Instruments, Renesas Electronics, etc.² The semiconductor industry is in a consolidation period and vendors leverage M&As to expand market share and grow rapidly. The market is a highly competitive landscape brought about by recent technological advances, including self-driving cars, vehicle connectivity, and interactive safety systems.

Refer to **exhibit 1** for details on how MCHP is positioned with respect to its competitors.

Cypress Semiconductor: Designs, manufactures, and markets programmable and mixed-signal solutions globally. The major operating segments are memory products division, data

¹ <https://www.investopedia.com/features/industryhandbook/semiconductor.asp>

² <https://www.businesswire.com/news/home/20170517005997/en/Top-7-Vendors-Global-Microcontrollers-Market-2017-2021>

communications division, programmable systems division, and emerging technologies division.

Infineon Technologies: Derives its revenue mostly from automotive, chip card and security, industrial power control, and power management and multimarket. **NXP Technologies:** Business segments include high-performance mixed-signal and standard products. The company acquired Freescale Semiconductor that brought core strengths to the combined organization, near field communication from NXP and MCUs from Freescale. **Renesas Electronics:** Based in Japan. They have three major segments that are MCU business, analog and power devices, and the SoCs. They offer microcontrollers for automotive, industrial equipment, and consumer electronics applications. **STMicroelectronics:** Core business segments include analog and MEMS group, automotive and discrete group, and microcontrollers and digital ICs group. **Texas Instruments:** Designs and manufactures semiconductors for electronics designers and manufacturers globally. It has two segments being analog and embedded processing. It provides low power and high-performance MCUs with wired and wireless connectivity options.

Refer to **exhibit 2** for a comparative financial analysis.

Our insight: MCHP is facing a highly competitive environment and has its work cut out. The revenue growth rate in this industry is in the low single digits. MCHP needs to prove that it's the most viable option while differentiating itself from the rest.

COMPANY OVERVIEW

HISTORY AND TIMELINE

Microchip Technology Inc. (incorporated: Delaware) is an American public corporation (NASDAQ: MCHP) and is a manufacturer of Microcontrollers, Flash-IP Integrated Circuits, mixed

signal and analog devices. Founded in 1987, when General Instrument spun off its microelectronics division as a wholly owned subsidiary, MCHP later became an independent company in 1989, and went public in 1993³. They believed in expanding their solutions through acquisitions and thus came a series of acquisitions post 2008. MCHP's first acquisition was in 1996, when it acquired ASiC Technical Solutions, Inc. for \$1.7 million⁴. This spun off more acquisitions for MCHP (Refer **Exhibit 3** of comprehensive list of MCHP acquisitions). In April 2009, MCHP announced the nanowatt XLP Microcontrollers, claiming the world's lowest sleep current. MCHP had sold more than 6 billion microcontrollers as of 2009. In January 2016, MCHP agreed to buy Atmel for \$3.56 billion. One of their recent acquisition was of Microsemi Corporation in March 2018 for \$10.15 Billion.

VISION AND MISSION

Vision: "Be the very best embedded control solutions company ever."⁵

Mission: "Microchip Technology Incorporated is a leading supplier of embedded control solutions by delivering a broad spectrum of innovative standard and specialized microcontrollers, FPGA products, analog, mixed-signal and security products, wired and wireless connectivity products, related non-volatile memory products and Flash-IP solutions. In order to contribute to the ongoing success of customers, employees, shareholders and the communities in which we operate, our mission is to focus resources on high value, high quality products and services, and to continuously improve all aspects of our business, providing an industry leading return on investment."⁶

³ https://en.wikipedia.org/wiki/Microchip_Technology#HI-TECH_Software

⁴ <http://www.mergentonline.com.libproxy.scu.edu/companydetail.php?pagetype=history&compnumber=76192>

⁵ <https://careers.microchip.com/about-us/vision-mission-and-guiding-values/>

PRODUCTS AND SERVICES

MCHP strategic focus is to provide low cost, highly effective embedded control solutions with multifold advantages such as high performance, small size, and ease of development etc. These advantages enable cost-effective and timely integration of their solutions by customers in their end products⁷. **Microcontrollers:** MCHP offers a broad family of proprietary microcontroller products marketed under brand names PIC and AVR. They have shipped about 22 billion microcontrollers worldwide since 1990. They have around 3000 microcontrollers in their portfolio and their primary focus is on 8, 16, and 32-bit microcontroller market (Refer **Exhibit 4** for History of Innovation of MCUs at MCHP). **Development Tools:** MCHP offers a comprehensive set of easy-to-learn and low-cost application development tools. These tools allow design engineers to develop application-specific products. MCHP has shipped about 2.4 million development tools till date. **Analog, Interface, Mixed Signal and Timing Products:** MCHP's products in this segment consist of several families with over 3,800 power management, thermal management, mixed-signal, other interface products etc. **Memory Products:** MCHP's memory products consist of Serial Flash memories, EEPROMs, Parallel Flash memories, EERAM, and Serial SRAM memories. MCHP sells memory products into the embedded control market to complement their microcontroller offering. **Technology Licensing:** This product line includes license fees and royalties associated with technology licenses for the use of MCHP's SuperFlash embedded flash and Smartbits one-time programmable NVM technologies and are licensed to design partners, foundries etc. **Multi-market and other:** This business offers manufacturing services (test subcontracting, wafer foundry and assembly),

⁶ <https://www.microchip.com/documentlisting/mission-statement>

⁷ <https://www.microchip.com/sec/annual/FY18/Form%2010-K%20filed%205-18-2018.pdf>

complex programmable logic devices, legacy application specific integrated circuits, and products for aerospace applications.

BUSINESS STRATEGY

MCHP's goal is to be worldwide leader in providing specialized semiconductor products for a wide variety of embedded control applications⁸. To achieve this, MCHP has a multi-pronged business strategy, the pertinent points of which have been highlighted below.

Strategic focus on embedded control solutions: MCHP is concentrating majority of its resources in providing customers with not only microcontrollers, but also development tools, wired and wireless connectivity products, memory products, technology licensing. To gain more customers, MCHP helps in making development process easier for customers. **Expanding solutions through acquisitions:** Around 2008, they recognized the fact for the semiconductor industry's need to consolidate. Industry was beginning to mature, and MCHP leveraged this opportunity to add another growth driver for revenue and earnings expansion - mergers and acquisitions. Since 2008, MCHP has completed 17 acquisitions (both public and private companies). These acquisitions helped add to their existing broad product portfolio, products and technologies that can be offered to customers. MCHP has found ways to transform acquired companies operating models from relatively poor performance to high performance by applying their systems, processes and culture. Acquisitions are now a core competency within MCHP today and they are expected to continue to be active in acquisitions while being price disciplined and patient in their approach. This helps the company grow both organically and inorganically. **Diversified products for differentiated end market:** MCHP is developing

⁸ <http://ww1.microchip.com/downloads/en/DeviceDoc/00002523A.pdf>

customized and diversified products for differentiated end market customers - General Purpose, Motor Control, Digital Signal Processing MCUs, Automotive parts with more temperature variance, etc. **Long term sustainable operating model:** 112 quarters of sustained profitability ever since company went public in 1993. Maintaining low operating expenses (~23%), while seeking to increase gross margins (~63%) every year⁹. **Diverse mix of geographical and segments end-customers:** By having a diverse mix of geographical and different segments end-customers, MCHP tries to insulate itself from geo-political cycles. MCHP sells to all countries that are not banned by US laws and regulations, and market segments include: consumer, automotive, industrial, office communication, computing, aerospace, and security. **R&D into new technologies/products:** MCHP heavily emphasizes on new products, technologies, development system to maintain competitive advantage. **Training Employees:** MCHP invests significantly into training of their employees as they believe it offers long term benefits, higher efficiency, increased safety, and lower attrition. **FSEs and FAEs:** Increased number of Field Sales and Applications engineers helps increase direct interactions with customers - honest feedback, more customizable solutions, and helps increase company goodwill. **Increased market penetration:** 115 distribution partners (Highest in industry) coupled with direct sales force (~50% of sales) allows for increased market penetration at lower costs¹⁰. **Sustained and Long-term leadership:** MCHP has had only one CEO (Steve Sanghi) ever since company went public ('93), and the executive team's junior-most member has served 16 years with MCHP. This provides for clear long-term policies and reduces confusion. **Stockholder**

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<https://www.microchip.com/investor/Supplemental/MCHP%20Presentation%20at%20the%20B%20of%20A%20Merrill%20Lynch%20Conference.060518.pdf>

¹⁰ <http://ww1.microchip.com/downloads/en/DeviceDoc/00002523A.pdf>

Return Strategy: Since MCHP went public, their stock price appreciation and dividend strategy have helped them produce consistent outstanding returns to stockholders. This has increased public confidence and market value. **Recognizing Sell-Through instead of Sell-in:** MCHP recognizes non-GAAP revenue and runs the company based on sales to end customers and not sales to distributors. This helps provide valuable insights to MCHP in recognizing customer seasonality. **Provide cost-effective embedded control solutions** - MCHP believes in offering advantages of small size, high performance parts at lower costs than found in the market. **Mix of in-house and third-party manufacturing:** By maintaining a delicate balance of in-house and third-party manufacturing, MCHP can achieve the following benefits. In-house manufacturing: reduced costs, cycle time, direct control over wafer starts, high level of manufacturing control and production yields. Third Party Manufacturing: Reduce capital investment into building fabs, immediate control over inventory (can cut wafer starts in a timely manner). **Proprietary Design and Manufacturing Process:** Maintaining architecture control through PIC and AVR. Cost effective designs, greater functionality in new product designs, easy to customize, reduced costs for external IPs and royalties. **In-house assembly and test:** MCHP does majority of their assembly and testing in-house to reduce costs and cycle time while having more control. **Global Network:** MCHP saves money by having a global network, and low-cost geo-centers and leveraging right segments for right geographies (example: design in USA, back end in India, assembly in Asia, etc. **Non-commissioned Sales force:** Allows for reduced costs, increased team-work, and no arm-twisting by customers. **Our recommendation/insight:** MCHP's business strategy appears to be robust and helps differentiate itself from its competitors. This can be seen from 112 quarters of continuous probability. MCHP's two main focus areas seem to be:

acquiring strategic companies and assets and offering low cost solutions. We recommend that MCHP continue their business strategy.

CORPORATE STRATEGIC ANALYSIS USING MODELS

External Analysis

Porter's Five Forces Analysis for Semiconductor industry:

Semiconductor industry is the aggregate collection of companies engaged in the design and fabrication of semiconductor devices. Below 5-forces model focuses only on the design aspect of the semiconductor industry which covers design of microprocessors, microcontrollers, memory and analog products.

Degree of Rivalry: HIGH Intensified: High product differentiation by architecture control, competitive pricing/services/support, better performance (& innovation) due to Moore's law, stronger brand loyalty (B2C companies such as Intel, AMD, Qualcomm), wider selection of customizable semiconductors as per customer's needs (General Purpose/Motor control/specific selection of peripherals), strong partnerships between PC/Smartphone manufactures and semiconductor companies (Ex: Apple-Intel) Weakened: commoditization of semiconductor modules **Threat of new entrants: LOW** Weakened: Large companies control market using economies of scale, setup of design labs requires enormous initial expenditure, require high technical expertise and R&D knowledge, Need for highly skilled (& highly trained) employees, high cost of Intellectual Property, current rate of M&As in Semiconductor industry is very high as industry is going through consolidation phase. Intensified: Attractiveness of growth (Semiconductor industry growth/Stock prices has outperformed other industries due to quality and quantity of technical innovations brought about by Moore's law), high profit margin.

Bargaining power of suppliers: MEDIUM Weakened: Low degree of differentiation, moderate switching cost, competitive global market, large companies use economies of scale to put pressure on suppliers. Intensified: Fewer number of suppliers - very niche in nature, Suppliers provide input materials/initial technology needed which can be very crucial

Bargaining power of buyers: HIGH in the beginning (Before Design-In), and MEDIUM TO LOW later (After Design-In phase) Weakened: High switching costs after “Design-In Phase”, technical knowledge required to switch between different semiconductor companies, Architectural control, joint marketing campaigns and agreements (Apple-Intel, Samsung-Qualcomm, Lenovo/Dell-Intel, etc.), low backward integration (example: manufacturers of desktops, PC do not have sufficient semiconductor design facilities, R&D facilities to develop in-house alternatives), Intensified: Competitive pricing, Even though companies have architectural control rival semiconductor companies can match feature set, semiconductors are commoditized up to design phase as lowest price is a crucial factor (when quality and feature set are same)

Threat of substitutes: LOW Traditional Semiconductors currently have no technically feasible and financially viable substitutes. Weakened: Rapidly changing industry does not allow substitutes to enter market, large companies can respond to a successful substitute by developing similar products

Role of Complements: Semiconductor companies with different focus and markets can have successful partnerships and become more powerful through coexistence such as partnerships between Memory-Microcontroller/Memory-Microprocessor/Microcontroller-Analog partnership etc. Appliance industry is a powerful complement to Microcontroller industry whereas PC/Smartphone industry is a powerful complement to microprocessor industry. With the coming of age of IoT, semiconductor chips are now virtually required in almost all applications.

Summary: The Semiconductor industry has seen several decades of high growth and profit thereby self-fulfilling the economic law known as Moore's Law. This industry has outpaced every other industry due to the need of semiconductors in every field. However, growth is slowing down in the industry as it is approaching the limits of Moore's law. Without a disruptive technology, semiconductors cannot be made any smaller due to basic laws of physics. The industry is going through a consolidation phase with many M&As. There is very high capital expenditure to grow, compete, or add capacity. Switching to better technology needs significant investment of time, energy and money. The semiconductor industry is entering the mature phase, and has its work cut out if it wants to grow. It needs to recognize that double digit growth and high profit margins are no longer possible, and the industry needs to double down, and focus on basics. However, good news is that with the advent of IoT, and "smart" cars/appliances, need for semiconductors is more now than ever before. Companies that invest smartly in R&D and manufacturing are best poised to make full use of this potential.

PESTEL Analysis

POLITICAL: US Federal Level: Trade wars and tariffs between countries (T). State level: Incentives & Special Economic Zones to increase footprint and presence in state (O). Global Presence: Military Coups threaten stability of company and employees (T). SEC (Or equivalent) could block Mergers and Acquisitions for political reasons (T). Tax policies could differ from year to year based on political climate (O & T). Shipping parts between countries being held by customs due to political reasons (T). Disruption in business due to war, terrorist activity, armed conflict (T). Competitors being unfairly helped by foreign state (T). **ECONOMICAL:** Depreciation of assets (T). Lowering of Average Selling Price (T). Recession (T). Rising inflation (T). Increasing

labor and material costs (T). Rising cost of US Dollar against weaker economies (Mostly T, but little O). Seasonality in Customer order patterns (T). Inventory management (O & T). Mergers and Acquisitions (O & T). Dividends for Shares (O & T) **SOCIAL:** Increase in Goodwill due to good quality, good customer service (O). Increased social media presence (O). Negative sentiment due to job loss (T) or due to mergers/acquisitions (T). **TECHNOLOGICAL:** Pressure to move to faster, smaller technologies (O & T). Lowering costs due to better technology (O & T). Technology becoming obsolete (T) Growth of Internet of Things (O) **LEGAL:** Lawsuits due to Contractual agreements and IP conflicts (T). Europe's GDPR Privacy laws (O & T). Threat of/actual lawsuits (T). Unauthorized copying of products and illegal reverse engineering leading to loss (T). Outcome of current or future tax audit (T). **ENVIRONMENTAL:** Environmental impacts of electronic manufacturing operations (T). Implementation of recently adopted environmental regulations (O & T). Large consumption of electricity for fabrication (T). Moving to alternate sources of energy (O & T). Rising costs due to climate change (T). Recycling (O & T). Disruption in business due to natural disaster (T). **Our recommendations/insight:** MCHP is currently sailing in rough stormy waters with a lot of factors beyond its control. MCHP needs to buckle down, watch for operating expenses, and continue sailing into calmer waters. It has effective strategies to counter some threats, but MCHP should not panic, and continue following their own guiding values.

Internal Analysis

SWOT Analysis:

Strengths: Wide geographic presence and Broad set of customers: Wide geographic customer

presence with majority of net sales coming from outside of USA. "Sales primarily in Asia and Europe, aggregated approximately 85% of consolidated net sales for fiscal years 2016-2018."¹¹. MCHP leveraged M&As to improve embedded solutions offering and broaden its market presence. They have about 115,000 customers from various segments - consumer, automotive, industrial, office communication, computing, aerospace, and security. **High-margin, profitable business model leveraging M&As:** MCHP had a record-breaking profit margin of 61.4% (2018), and their gross margins increased by about 400 BPS since FY2010¹². Gross margin (%) is higher than 93% of 843 companies in the Global Industry (industry Gross margin median is 27.5%)¹³. Foresight and planning have helped them to integrate successful M&As with their current business model. Their model allows them to generate free cash flow which helps cover their debts developed due to mergers and contribute this cash flow to new acquisitions and dividends. **Strong Distribution Channel:** MCHP Technology has about 115 distribution channels to serve a broad customer base effectively. Distribution partners have contributed to ~55% of sales in FY 2017 and 2018 respectively¹⁴. **Heavy Investment in R&D:** Semiconductor design and process technologies are subject to rapid technological change and require significant R&D expenditures. MCHP has significantly increased their R&D expenses to stay in line with these technology changes, exceed customer expectations by providing new technology on their products - eventually paying off great profits.

¹¹ https://csimarket.com/stocks/markets_glance.php?code=MCHP

¹²

<https://www.microchip.com/investor/Supplemental/MCHP%20Presentation%20at%20the%20B%20of%20A%20Merrill%20Lynch%20Conference.060518.pdf>

¹³

<https://www.gurufocus.com/term/grossmargin/MCHP/Gross-Margin-/Microchip-Technology-Inc>

¹⁴ <https://www.microchip.com/sec/annual/FY18/Form%2010-K%20filed%205-18-2018.pdf>

Weakness: Distributor Loyalty: MCHP does not have long-term agreements with their distributors which could disrupt sales. Loss/disruption to any distributor could reduce net sales and increase inventory returns. **Competition and saturation of semiconductor industry:** MCHP faces pressures related to heavy competition and competitive pricing which can eventually reduce MCHP market share. The ongoing consolidation in semiconductor industry adds to MCHP's woes. "Growth is slowing, and the physical limitations in designing thinner and more minute silicon transistors are making it harder to keep pace with Moore's Law"¹⁵, an observation and prediction by Intel Corp.

Opportunities: New Technology evolutions: IOT technologies come with long term growth prospectus in the market. MCHP's acquisition of Microsemi has strengthened their position by offering broad range of products in IOT (estimated ~ \$130B) and AI market segments¹⁶. MCHP is making a splash by expanding their ethernet portfolio to serve this industry. MCHP can expect a robust growth in revenue through its MCU sales as IOT devices depend upon MCUs for connectivity and data collection. **Free Cash Flow and Acquisitions:** MCHP operating model and low capital-intensive drives majority of cash flow generation. Free cash flow as a percentage of revenue was 28.9% in fiscal 2017 which grew to 33.2% in the first quarter of 2018¹⁷. This cash flow allows them to make appropriate investments, pay a significant dividend to their stockholders and continue to look for complimentary acquisition opportunities. These acquisitions can help MCHP survive stagnant growth and industry consolidation. **Threats: Intellectual property protection:** Failing to protect their intellectual property is causing

¹⁵ http://web.eng.fiu.edu/npala/eee6397ex/gordon_moore_1965_article.pdf

¹⁶ <https://www.windpowerengineering.com/business-news-projects/global-iot-market-to-reach-318-billion-by-2023-says-globaldata/>

¹⁷ <https://www.microchip.com/sec/annual/FY18/Form%2010-K%20filed%205-18-2018.pdf>

problems to MCHP in their revenue. Their products are getting cloned, pirated and reversed our product lines in such countries as China and Taiwan which is affecting their sales. Use of subcontractors increases the risks of potential misappropriation of their intellectual property. Further, the laws of few foreign countries often fail to protect their intellectual property rights to the same extent as the laws of the U.S. **Trade wars:** Trade wars between China and USA is currently posing a threat to MCHP. Sales to customers in China, including Hong Kong, accounted for approximately 30% of MCHP's net sales in 2018¹⁸. Tariffs associated with the trade wars is making the international customers in China nervous. These economic wars are also hurting business confidence, making investors reduce their investments. Snapance added that "those concerns are indeed negatively affecting order activity as well as distribution sell-through for customers."¹⁹ MCHP has passed along the cost of the tariffs to the customers in China by increasing the selling price by 25% on average. However, in the future, things can turn out differently if there is a trade settlement between USA and China.

Our recommendations/Insights: MCHP is playing to its strengths in a highly competitive market. However, MCHP can convert some weakness into opportunities by signing long term agreements with distributors, invest more into Research and Development, get a head-start on IoT and security products and tweak their supply chain logistics to reduce tariffs.

VALUE CHAIN ANALYSIS

Primary Activities: Inbound Logistics: MCHP usually has multiple suppliers and subcontractors but at times they depend on single or limited suppliers. They have plans to reduce exposure

¹⁸ <https://www.fool.com/investing/2018/08/10/why-microchip-technology-stock-plunged-today.aspx>

¹⁹ <http://ww1.microchip.com/downloads/en/DeviceDoc/00002523A.pdf>

that would result from disruption in supply. **Research and Development:** Currently, they are developing design, assembly, testing and processing technology to enable new products and features which can reduce costs and improve performance. However, transitioning to advanced process technologies could reduce manufacturing yields or cause delays in product deliveries affecting future operating results if this transition is delayed or inefficiently implemented.

Operations: High level of control due to ownership of manufacturing resources such as wafer fabrication, assembly and test operations. Lowest cost producers. Short design and production cycles. Employ statistical process control, designed experiments and wafer level monitoring. Outsourcing to third party assembly and test contractors has increased. Foundry lead times affect ability to satisfy customer orders. Subcontractors could abandon fabrication processes or fail to adopt advanced manufacturing technologies desired to control costs.

Outbound Logistics: Short delivery schedules. Standard products that can be shipped from inventory within relatively short time after receiving order. No long-term contracts with customers. If entered into contract, can be cancelled at customer's convenience. May incur additional costs in case of inability to fulfil customer order. **Marketing:** Strong technical personnel in sales management team, diverse customer base, 60% revenue from industrial and automotive industry having long product life. 115 distribution partners with 115,000 customers worldwide. Direct sales channels. Low price. No single customer/distributor accounts for more than 10% of net sales²⁰. No long-term agreements with distributors and they can be terminated or leave with little or no notice. **Services:** Online custom programming services to customers. Full-service channel for purchasing needs. Low cost & easy to learn app development tools.

²⁰ <https://www.microchip.com/sec/annual/FY18/Form%2010-K%20filed%205-18-2018.pdf>

Support Activities: Firm Infrastructure: MCHP possess proprietary product architecture. They also have cross licenses with other companies. Copying, cloning, reverse engineering of proprietary product lines has been a threat to them. Foreign countries fail to protect intellectual property rights to the same extent as that of US. Litigation could result in substantial costs requiring attention from management to enforce IP rights or to defend against claimed infringement of right of others. Changes in environmental regulations could need purchase of new equipment and failure to abide by them could result in significant liabilities.

Human Resource Management: Conducts periodic technical training sessions and workshops. Eclectic team with people having diverse qualifications. No work stoppages. **Technology Development:** Timely development and introduction of new and enhanced technology. No surety that enhanced or new technology will achieve or maintain substantial market acceptance. **Procurement:** In most cases, they obtain necessary licenses on commercially reasonable terms. Acquired certain patents and intend to continue doing so. Demand letters from third parties asserting infringement of patent and other intellectual property rights. Failure to obtain necessary licenses could harm the business.

FINANCIAL ANALYSIS

MCHP is thriving with impeccable growth over the years - current net worth of \$5170.20 million and a significant increase in revenue of ~300% from 2010 to 2018. Net sales for fiscal 2018 compared to fiscal 2017 increased by 14.0%²¹. Microcontrollers and associated application development systems accounted for approximately 65.9% of MCHP net sales in fiscal 2018 (Net sales by product line in *exhibit 5*). R&D expenses decreased \$16.0 million, or 2.9%, for fiscal

²¹ <https://www.microchip.com/sec/annual/FY18/Form%2010-K%20filed%205-18-2018.pdf>

2018 compared to fiscal 2017 primarily due to reductions in personnel and associated costs in connection with synergies realized from Atmel acquisition (**MCHP Statement of Income, Cash flows in *exhibits 6***). However, their recent acquisition of Microsemi has resulted in an enormous increase of debt from \$1,826.26 (2015) million to \$11,349.6 million (2018). MCHP level of debt (204.3%) compared to net worth is high (greater than 40%) and has increased over the past 5 years (49.1% vs 204.3% today). MCHP is among top 3 dividend payers in the semiconductor industry with their dividend increasing from \$291 million (2016) to \$337 million (2018)²². **Our recommendations/Insights:** MCHP has an exemplary track record with respect to their financial health. They have 112 quarters of continuous profitability with healthy gross margins, and stellar revenue growth. However, recently with consecutive high-value acquisitions, MCHP is exposed to a lot of debt (~\$10B). The annual interest payments alone are an astounding ~\$400 million (Based on 4% Market Interest). To maintain the integrity of its stocks, MCHP must continue to pay its shareholders a dividend. All of this adds up, and MCHP's cash flow is barely enough to meet the above needs (+ capital expenditures). We recommend that - MCHP must significantly reduce its operating expenses and pay off the loan as quickly as possible.

BALANCED SCORECARD

How will MCHP differ if their vision succeeds: Financial perspective (MCHP shareholders):

Success factors: Increase shareholder values, Ensure company growth, Increase operating profitability, Diversification of customer base Critical Measures: Increase in dividend, stock growth and stock price, Increase in earnings per share, GAAP and non GAAP revenue, Operating

²² <https://simplywall.st/stocks/us/semiconductors/nasdaq-mchp/microchip-technology>

expense and EBITDA **Customer perspective (MCHP customers):** Success factors: Goal of zero defects, Increased customer satisfaction, Offer exemplary customer service, Offer total system solution and embedded control. Critical Measures: ISO/TS16949 certification and AOQ/LRR, Customer satisfaction surveys, Number of FAE, FSE and their feedback, Number of mergers and acquisitions **Internal perspective (MCHP internal management process):** Success factors: Improve employee engagement, Increased safety, Increase company-wide communication, Improve inventory management Critical Measures: Mean & median scores of employee response to anonymous guiding value questionnaire, Number of workplace safety incidents, Track & measure one on one round table meetings (all hands/town hall meetings), Inventory days target for both MCHP & external distribution **Innovation & Learning perspective (MCHP ability to innovate and grow):** Success factors: New technology innovation, Optimized product cycle time, Improve new product development, Improve employee skills Critical measures: Number of patents & amount of intellectual property developed, Fab cycle time, new product development cycle time, testing cycle time and package cycle time, KPI: ratio of new product development revenue (past 3 years) to total revenue, Anonymous employee questionnaires, self-appraisal **Our recommendations/Insights:** Microchip's culture and guiding values are very strong, and they will ensure the success of MCHP. We recommend - MCHP follows the above balanced scorecard goals to the T and measure and analyze each of these tangible goals periodically.

S-CURVE ANALYSIS (TECHNOLOGY ANALYSIS)

In 1965, Gordon Moore famously prophesied that density of transistors on integrated circuits

will double every 18 months (Moore's Law). The 'S' curve for semiconductor industry follows Moore's law. Refer **exhibits 7** on Intel's S-Curve. An important note here is that microprocessors need to be at bleeding edge of new technologies (due to faster processing power), microcontrollers need not. Microcontrollers are more valued for their versatile nature, peripherals, etc. Beyond a point, speed of microcontrollers do not matter as they interact with analog devices, and analog can only go so fast. Disclaimer: As Intel is mostly a B2C customer, technology node is their advertisement. However, for MCHP (B2B), technology node is not a differentiating factor and maybe a drawback (faster technology nodes have higher leakages). There is no public data about technology nodes that MCHP uses. However, we can safely assume that MCHP follows a similar S-curve. MCHP lags behind on S-curve (by at least a few years) as its business strategy is focused on low cost embedded solutions. It waits for technology to mature, bugs to iron out, and understand process corners of technology before moving to that technology node. The costs associated with moving to next technology nodes is exponential due to higher equipment costs (Requires 1.4x equipment to achieve same throughput at 14 nm as compared to previous), more resources needed (1.5x R&D), new fab costs (Billions), and it takes longer to process because of multi-patterning. Also, as technology node reduces in size, number of foundries handling that technology drastically reduces (**Exhibit 8**). **Our Analysis/Insights:** MCHP is trailing most companies on 'S' curve, but it seems to be an intentional play. MCHP does not need to be at the forefront of the 'S' curve due to reasons mentioned above and it can save on R&D costs by using more mature technologies. However, MCHP can leap several technologies with little effort as they acquire various design IPs from strategic acquisitions (usually higher up on S-curve). Since MCHP works with external foundries,

as long as it has design IPs, it does not need to invest into latest fabs to climb up the 'S' Curve. We agree with MCHP strategy, but we recommend that MCHP not get too complacent, or fall way behind the 'S' Curve. At a certain point if MCHP does not catch-up, they will lose their competitive advantage.

RISK ASSESSMENT

Our analysis of MCHP's current business strategy gives some interesting insights and potential risks which MCHP would have to consider in planning their future strategy. These risks to MCHP could be internal/external. **Internal Factors:** MCHP current strategy to leverage M&As to expand their current offering has exposed them to enormous levels of debt. Ineffective management of debt could affect their financial condition and operations adversely in the event of an economic downturn. Servicing their current debt and future debts due to Microsemi acquisition needs significant amount of cash. Cash flows from other business are not on par with their 8-bit MCU market, resulting in insufficient cash flow to fund future payments. Interruptions in MCHP's information technology systems, or improper handling of data, could adversely affect them. **External Factors:** MCHP's business strategy makes them heavily reliant on distribution sales channels, foreign sales which exposes them to risks caused by changes in geo-political & economic policies. MCHP relies on wafer foundries and contractors to perform key manufacturing functions exposing them to risks which could disrupt their business in the event of environmental disasters, climate change policies etc. MCHP financial condition and operations could be adversely affected from changes in tax rules, regulations/interpretations. MCHP faces intense competition in markets which results in pricing pressures, risk of reduced sales of their products and/or reduced market share.

APPENDIX A: Exhibits

Exhibit 1: MCHP vs Industry Competitors Rankings

<u>No.</u>	<u>2003 Rank</u>	<u>2008 Rank</u>	<u>2009 Rank</u>	<u>2010 Rank</u>	<u>2012 Rank</u>	<u>2014 Rank</u>	<u>2015 Rank</u>	<u>2016 Rank</u>
1	Renesas	Renesas	Renesas	Renesas	Renesas	Renesas	Renesas	Renesas
2	Motorola	NEC	NEC	Freescale	Freescale	Freescale	NXP	NXP
3	NEC	Freescale	Freescale	Samsung	Infineon	ST-Micro	ST-Micro	Microchip
4	Matsushita	Infineon	Samsung	Microchip	Microchip	Microchip	Microchip	ST-Micro
5	Infineon	Samsung	Microchip	Atmel	ST-Micro	NXP	Infineon	TI
6	Fujitsu	Microchip	TI	TI	TI	TI	TI	Infineon
7	Toshiba	ST-Micro	Infineon	Infineon	Atmel	Infineon	Atmel	Cypress
8	Microchip	TI	ST-Micro	ST-Micro	NXP	Atmel	Cypress	Samsung
9	Samsung	Fujitsu	Fujitsu	Fujitsu	Fujitsu	Spansion	Samsung	CEC Huada
10	ST-Micro	NXP	NXP	NXP	Samsung	Samsung	CEC Huada	Toshiba

Based on dollar shipment volume 2003-2016, Source: Gartner and Microchip

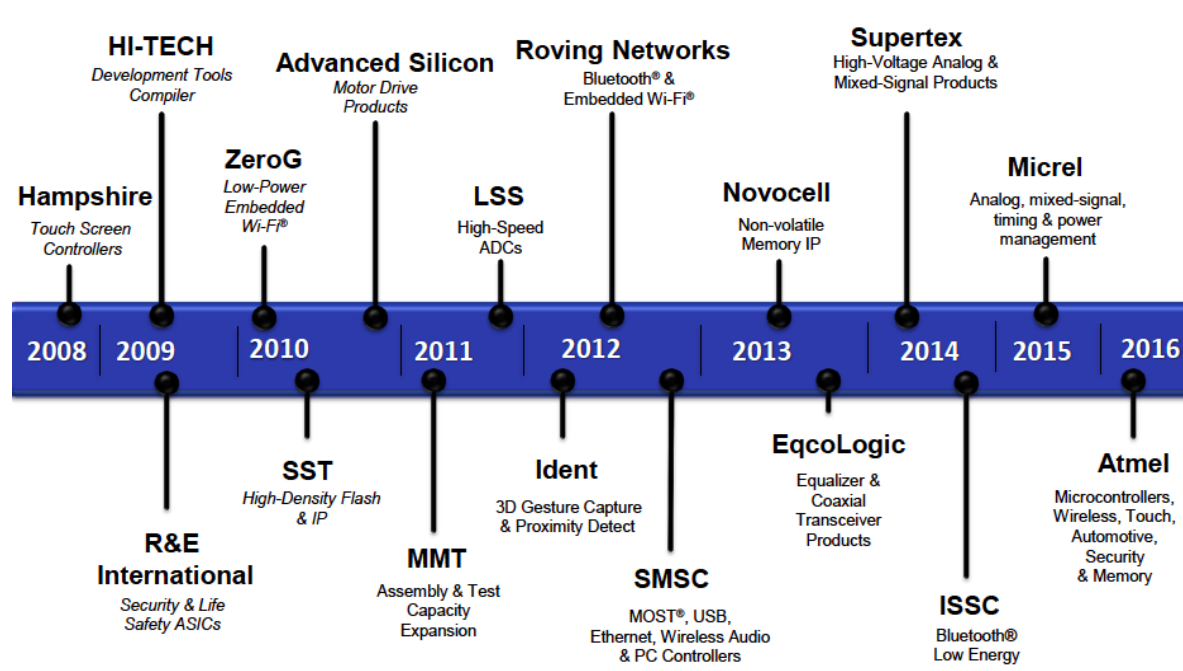
Source: Microchip Company Data

Exhibit 2: MCHP vs Industry Competitors Select Financial Data

Company	Ticker	Stock Price on 03/15	Annual Revenue	Net Income	Market Cap	Annual Revenue Growth Rate
Microchip	MCHP	\$86.10	\$5.022B	\$255.4M	\$20.40B	5.50%
Cypress	CY	\$15.34	\$2.48 B	\$354.8 M	\$5.58B	-2.60%
Infineon	IFX.DE	\$22.45	\$8.836B	\$1.218B	\$22.388B	7.50%
NXP	NXPI	\$3.00	\$9.4 B	\$2.20B	\$30.69B	1.90%
Renesas	RNECY	\$2.34	\$6.78B	\$5.29B	\$7.83B	3.90%
STMicroelectronics	STM	\$16.46	\$9.66B	\$1.293B	\$14.99B	3.80%
Texas Instruments	TXN	\$110.74	\$15.794B	\$5.54B	\$103.94B	0.70%

Source: Financial Data from simplywall.st and finance.yahoo.com

Exhibit 3: Microchip Technology Inc., Timeline of Acquisitions

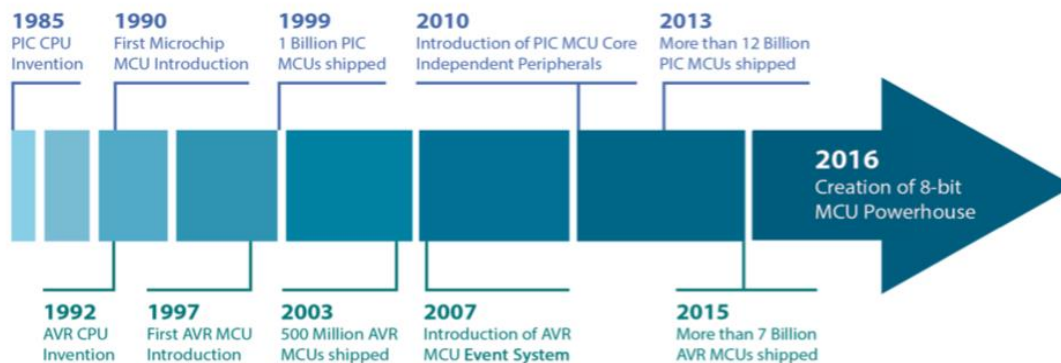


Source: Microchip Company Data

Exhibit 4: History of Innovation of MCU at Microchip Technology Inc.,

History of Innovation

PIC® MCU



AVR® MCU

Source: Microchip Company Data

Exhibit 5: Microchip Technology Inc., Net Sales by Product Line

	Year Ended March 31,					
	2018	%	2017	%	2016	%
Microcontrollers	\$ 2,619.1	65.9	\$ 2,147.3	63.0	\$ 1,345.5	61.9
Analog, interface, mixed signal and timing products	952.0	23.9	888.9	26.1	595.5	27.4
Memory products	199.7	5.0	184.1	5.4	116.9	5.4
Technology licensing	104.8	2.6	91.2	2.7	89.1	4.1
Multi-market and other	105.2	2.6	96.3	2.8	26.3	1.2
Total net sales	<u>\$ 3,980.8</u>	<u>100.0</u>	<u>\$ 3,407.8</u>	<u>100.0</u>	<u>\$ 2,173.3</u>	<u>100.0</u>

Source: Microchip Technology Inc, Inc. 10-K filed May 18th, 2018.

Exhibit 6a: Microchip Technology Inc., & Subsidiaries Consolidated Statement of Income

MICROCHIP TECHNOLOGY INCORPORATED AND SUBSIDIARIES CONSOLIDATED STATEMENTS OF INCOME

(in millions, except per share amounts)

	Year ended March 31,		
	2018	2017	2016
Net sales	\$ 3,980.8	\$ 3,407.8	\$ 2,173.3
Cost of sales (1)	1,560.1	1,650.6	967.8
Gross profit	2,420.7	1,757.2	1,205.5
Research and development (1)	529.3	545.3	372.6
Selling, general and administrative (1)	452.1	499.8	301.7
Amortization of acquired intangible assets	485.5	337.7	174.9
Special charges and other, net	17.5	98.6	4.0
Operating expenses	1,484.4	1,481.4	853.2
Operating income	936.3	275.8	352.3
Losses on equity method investments	(0.2)	(0.2)	(0.3)
Other income (expense):			
Interest income	22.0	3.1	24.4
Interest expense	(199.0)	(146.3)	(104.0)
Loss on settlement of convertible debt	(16.0)	(43.9)	—
Other (loss) income, net	(5.8)	1.3	8.9
Income before income taxes	737.3	89.8	281.3
Income tax provision (benefit)	481.9	(80.8)	(42.6)
Net income from continuing operations	255.4	170.6	323.9
Discontinued operations:			
Loss from discontinued operations	—	(7.6)	—
Income tax benefit	—	(1.6)	—
Net loss from discontinued operations	—	(6.0)	—
Net Income	255.4	164.6	323.9
Less: Net loss attributable to noncontrolling interests	—	—	0.2
Net income attributable to Microchip Technology	\$ 255.4	\$ 164.6	\$ 324.1
Basic net income per common share attributable to Microchip Technology stockholders			
Net income from continuing operations	\$ 1.10	\$ 0.79	\$ 1.59
Net loss from discontinued operations	\$ —	\$ (0.03)	\$ —
Net income attributable to Microchip Technology	\$ 1.10	\$ 0.76	\$ 1.59
Diluted net income per common share attributable to Microchip Technology stockholders			
Net income from continuing operations	\$ 1.03	\$ 0.73	\$ 1.49
Net loss from discontinued operations	\$ —	\$ (0.02)	\$ —
Net income attributable to Microchip Technology	\$ 1.03	\$ 0.71	\$ 1.49
Dividends declared per common share	\$ 1.449	\$ 1.441	\$ 1.433
Basic common shares outstanding	232.9	217.2	203.4
Diluted common shares outstanding	248.9	234.8	217.4
(1) Includes share-based compensation expense as follows:			
Cost of sales	\$ 13.8	\$ 18.7	\$ 8.3
Research and development	42.5	46.8	32.0
Selling, general and administrative	36.9	62.6	31.1

Source: Microchip Technology Inc., Inc. 10-K filed May 18th, 2018.

Exhibit 6b: Microchip Technology Inc., & Subsidiaries Consolidated Balance Sheets

MICROCHIP TECHNOLOGY INCORPORATED AND SUBSIDIARIES CONSOLIDATED BALANCE SHEETS (in millions, except share amounts)

	March 31,	
	2018	2017
ASSETS		
Cash and cash equivalents	\$ 901.3	\$ 908.7
Short-term investments	1,295.3	394.1
Accounts receivable, net	563.7	478.4
Inventories	476.2	417.2
Prepaid expenses	63.9	41.3
Assets held for sale	—	6.4
Other current assets	55.9	58.9
Total current assets	3,356.3	2,305.0
Property, plant and equipment, net	767.9	683.3
Long-term investments	—	107.5
Goodwill	2,299.0	2,299.0
Intangible assets, net	1,662.0	2,148.1
Long-term deferred tax assets	100.2	68.9
Other assets	71.8	75.1
Total assets	\$ 8,257.2	\$ 7,686.9
LIABILITIES AND STOCKHOLDERS' EQUITY		
Accounts payable	\$ 144.1	\$ 149.2
Accrued liabilities	229.6	212.5
Deferred income on shipments to distributors	333.8	292.8
Current portion of long-term debt	1,309.9	50.0
Total current liabilities	2,017.4	704.5
Long-term debt	1,758.4	2,900.5
Long-term income tax payable	754.9	184.9
Long-term deferred tax liability	205.8	409.1
Other long-term liabilities	240.9	217.2
Stockholders' equity:		
Preferred stock, \$0.001 par value; authorized 5,000,000 shares; no shares issued or outstanding	—	—
Common stock, \$0.001 par value; authorized 450,000,000 shares; 253,232,909 shares issued and 235,027,767 shares outstanding at March 31, 2018; 249,463,733 shares issued and 229,093,658 shares outstanding at March 31, 2017	0.2	0.2
Additional paid-in capital	2,562.5	2,537.4
Common stock held in treasury: 18,205,142 shares at March 31, 2018; 20,370,075 shares at March 31, 2017	(662.6)	(731.9)
Accumulated other comprehensive loss	(17.6)	(14.4)
Retained earnings	1,397.3	1,479.4
Total stockholders' equity	3,279.8	3,270.7
Total liabilities and stockholders' equity	\$ 8,257.2	\$ 7,686.9

Source: Microchip Technology Inc, Inc. 10-K filed May 18th, 2018.

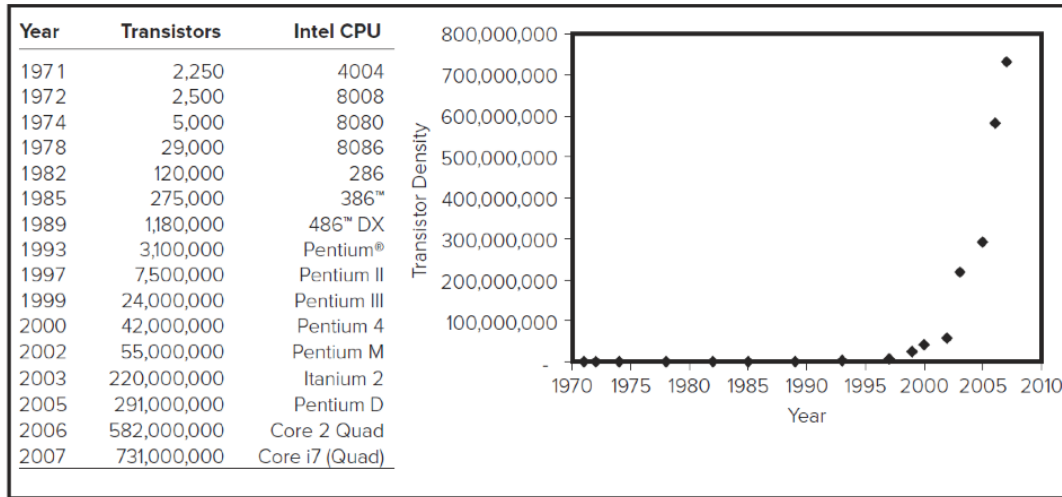
Exhibit 6c: Microchip Technology Inc., & Subsidiaries Consolidated Statement of Cash Flows

	Year ended March 31,		
	2018	2017	2016
Cash flows from operating activities:			
Net income	\$ 255.4	\$ 164.6	\$ 323.9
Adjustments to reconcile net income to net cash provided by operating activities:			
Depreciation and amortization	615.9	469.2	283.2
Deferred income taxes	51.2	(126.9)	(60.4)
Share-based compensation expense related to equity incentive plans	93.2	128.1	71.4
Excess tax benefit from share-based compensation	—	—	(0.8)
Loss on settlement of convertible debt	16.0	43.9	—
Amortization of debt discount on convertible debt	106.1	56.1	48.0
Amortization of debt issuance costs	6.6	4.5	4.0
Losses on equity method investments	0.2	0.2	0.3
Gains on sale of assets	(5.9)	(0.1)	(1.0)
Loss on write-down of fixed assets	0.1	2.6	—
Impairment of intangible assets	0.5	11.9	0.6
Realized losses (gain) on available-for-sale investments	—	0.1	(13.7)
Realized gain on equity method investment	—	(0.4)	(2.2)
Impairment of available-for-sale investment	15.5	1.4	4.0
Amortization of premium on available-for-sale investments	0.3	—	9.0
Changes in operating assets and liabilities, excluding impact of acquisitions:			
Increase in accounts receivable	(85.3)	(46.8)	(2.1)
(Increase) decrease in inventories	(59.2)	223.7	48.2
Increase in deferred income on shipments to distributors	41.0	109.4	17.0
Decrease in accounts payable and accrued liabilities	(13.9)	(14.8)	(26.4)
Change in other assets and liabilities	14.0	25.7	0.1
Change in income tax payable	367.9	(2.2)	41.3
Operating cash flows related to discontinued operations	—	9.3	—
Net cash provided by operating activities	1,419.6	1,059.5	744.4
Cash flows from investing activities:			
Purchases of available-for-sale investments	(1,594.8)	(500.3)	(1,573.9)
Maturities of available-for-sale investments	786.7	0.4	1,322.7
Sales of available-for-sale investments	—	470.2	1,501.5
Sale of equity method investment	—	1.7	2.7
Acquisition of Atmel, net of cash acquired	—	(2,747.5)	—
Acquisition of Micrel, net of cash acquired	—	—	(343.9)
Purchase of additional controlling interest in ISSC	—	—	(18.0)
Investments in other assets	(7.1)	(10.2)	(7.1)
Proceeds from sale of assets	10.3	23.0	14.3
Capital expenditures	(206.8)	(75.3)	(97.9)
Net cash (used in) provided by investing activities	(1,011.7)	(2,838.0)	800.4
Cash flows from financing activities:			
Payments on settlement of convertible debt	(73.4)	(436.2)	—
Proceeds from issuance of 2017 senior debt	—	2,070.0	—
Proceeds from issuance of 2017 junior debt	—	575.0	—
Repayments of revolving loan under credit facility	(187.0)	(2,781.0)	(1,614.4)
Proceeds from borrowings on revolving loan under credit facility	187.0	1,537.0	2,204.5
Deferred financing costs	(1.2)	(36.9)	(2.2)
Payment of cash dividends	(337.5)	(315.4)	(291.1)
Repurchase of common stock	—	—	(363.8)
Proceeds from sale of common stock	42.0	42.2	28.7
Tax payments related to shares withheld for vested restricted stock units	(44.4)	(58.4)	(21.7)
Capital lease payments	(0.8)	(0.8)	(0.6)
Excess tax benefit from share-based compensation	—	—	0.7
Net cash (used in) provided by financing activities	(415.3)	595.5	(59.9)

Source: Microchip Technology Inc., Inc. 10-K filed May 18th, 2018.

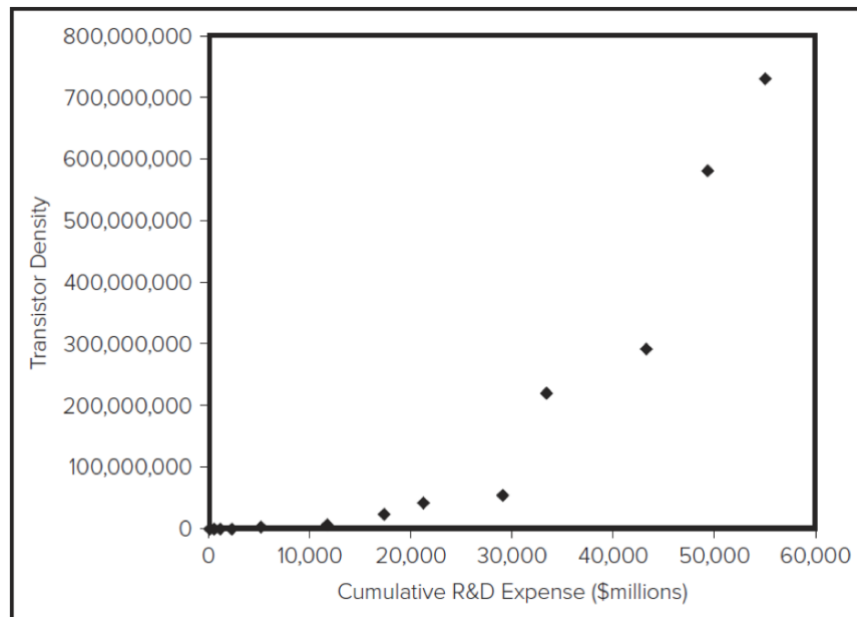
Exhibit 7a: Intel's 'S' Curve (Density vs time)

Improvements in Intel's Microprocessor Transistor Density over Time



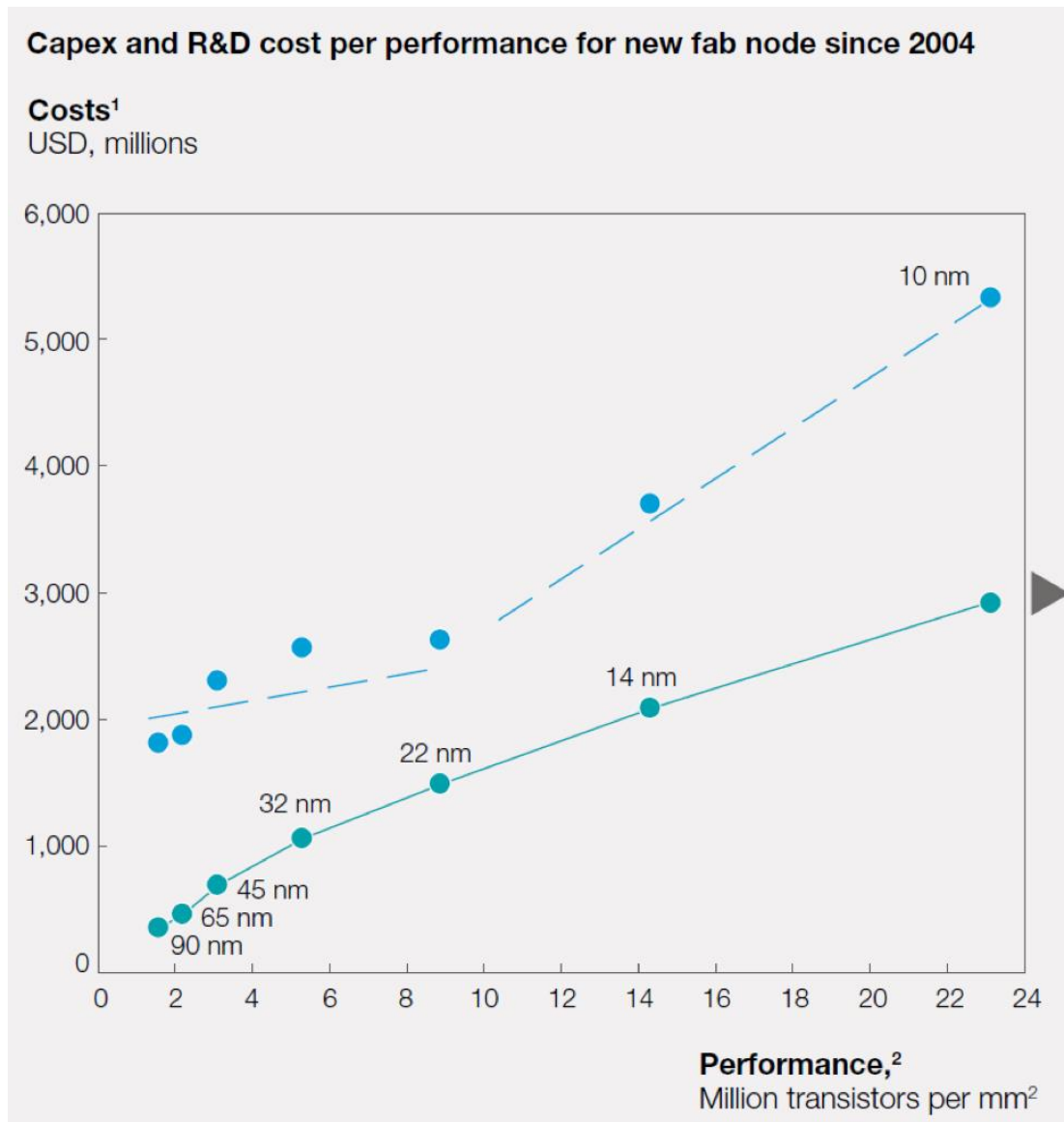
Source: Melissa Schilling - Strategic Management of Technological Innovation (2017, McGraw-Hill Education)

Exhibit 7b: Intel's economic 'S' Curve: (Density vs Cost)



Source: Melissa Schilling - Strategic Management of Technological Innovation (2017, McGraw-Hill Education)

Exhibit 7c: Capex and R&D cost per performance for new fab node since 2004 for Intel



Source: isupply, press search, SEMI world Fab watch: Graphene: The next S-Curve for semiconductors by Gaurav Batra, Nick Santhanam, Kushan Surana

Exhibit 8: Foundries with cutting edge logic fab

Number of Foundries with a Cutting Edge Logic Fab										
SiTerra										
X-FAB										
Dongbu HiTek										
ADI	ADI									
Atmel	Atmel									
Rohm	Rohm									
Sanyo	Sanyo									
Mitsubishi	Mitsubishi									
ON	ON									
Hitachi	Hitachi									
Cypress	Cypress	Cypress								
Sony	Sony	Sony								
Infineon	Infineon	Infineon								
Sharp	Sharp	Sharp								
Freescall	Freescall	Freescall								
Renesas (NEC)	Renesas	Renesas	Renesas	Renesas						
SMIC	SMIC	SMIC	SMIC	SMIC						
Toshiba	Toshiba	Toshiba	Toshiba	Toshiba						
Fujitsu	Fujitsu	Fujitsu	Fujitsu	Fujitsu						
TI	TI	TI	TI	TI						
Panasonic	Panasonic	Panasonic	Panasonic	Panasonic	Panasonic					
STMicroelectronics	STM	STM	STM	STM	STM					
UMC	UMC	UMC	UMC	UMC	UMC					
IBM	IBM	IBM	IBM	IBM	IBM	IBM				
AMD	AMD	AMD	GlobalFoundries	GF	GF	GF	GF			
Samsung	Samsung	Samsung	Samsung	Samsung	Samsung	Samsung	Samsung	Samsung	Samsung	
TSMC	TSMC	TSMC	TSMC	TSMC	TSMC	TSMC	TSMC	TSMC	TSMC	
Intel	Intel	Intel	Intel	Intel	Intel	Intel	Intel	Intel	Intel	Future
180 nm	130 nm	90 nm	65 nm	45 nm/40 nm	32 nm/28 nm	22 nm/20 nm	16 nm/14 nm	10 nm	7 nm	5 nm

Source: https://en.wikichip.org/wiki/technology_node

APPENDIX B: Additional References

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