Semiconductors

Information Technology Sector

**Investment Thesis**

The outlook for the semiconductor industry is positive, notwithstanding the decelerating growth that its end market products witnessed in 2015. The semiconductor industry is levered strongly to the growth prospects of Internet of Things and Big Data. These end market segments of the semiconductor industry will contribute to the 6-9% top line growth of the industry in the coming years. A positive earnings outlook that is expected to outperform the earnings of S&P 500 is the driver for the overweight recommendation for the industry.

**Drivers of Thesis**

- An increase in the popularity of wearables technologies as well as Internet of Things (IOT) will provide a fillip to revenue growth of the semiconductor industry. The IoT market is expected to grow from $500 billion in 2015 to over 1.5 trillion dollars in 2019. (1)
- The market for big data is expected to grow at 10% CAGR to reach $85 billion by 2026. (21) The semiconductor industry is strongly leveraged to this data growth paradigm.
- An increase in semiconductor R&D spending to make advanced technology nodes commercially viable will drive sales globally.

**Risks to Thesis**

- The median exposure to the semiconductor revenues to China is close to 40%. A severe downturn in the Chinese economy will depress the end market demand for products such as Smartphones, PCs, and other mobile devices. This will hamper the organic growth prospects of the industry. (4)
- Increases in fed funds rate will make the cost of capital for this sector dearer. This would hamper the upswing in the M&A activities that was seen from 2012 to 2015. (3)
- Companies within the industry have overseas sales account for 80-85% of revenue. Strengthening of the US dollar will drive revenues from foreign sales down. (4)

**Key US traded companies by Market Cap (B)**

<table>
<thead>
<tr>
<th>Company</th>
<th>Market Cap</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intel Corporation (INTC)</td>
<td>$145.44</td>
</tr>
<tr>
<td>TSMC (TSM)</td>
<td>$111.57</td>
</tr>
<tr>
<td>Texas Instruments (TXN)</td>
<td>$53.59</td>
</tr>
<tr>
<td>Broadcom LTD (AVGO)</td>
<td>$38.07</td>
</tr>
<tr>
<td>NXP Semiconductors (NXPI)</td>
<td>$27.33</td>
</tr>
</tbody>
</table>

**Peer Company Statistics**

- Price/Earnings: 16.09
- DOI: 70.84
- Book to Bill ratio: 0.99
- Debt/Equity: 49.25%
- Foreign sales % revenue: 80-85%
- ROE: 22.93%
- Gross Margin (%): 52.76%
- Net Margin (%): 23.09%
- EV/EBITDA: 7.73
- EV/Sales: 3.36

**Industry Description**

The Semiconductor industry comprises of firms involved in the design and fabrication of semiconductor devices. The semiconductor devices can be broadly classified into 3 main categories: Memories, Processors, Standard and Application Specific Integrated Circuits (ASIC). The end market for these products include but aren’t limited to devices and systems such as Smartphones, Personal Computer (PC), Tablets, and other electronic devices.

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*Important disclosures appear on the last page of this report.*
EXECUTIVE SUMMARY

The semiconductor industry as a whole is expected to see a modest revenue growth of 2.8% in 2016. (4) The trends in IoT and big data suggest robust long term growth prospects for the semiconductor industry.

This industry has seen an increase in consolidation activities that has helped in expanding volume and controlling costs. The M&A activities have also helped in aligning R&D efforts and investments in next generation technologies. The moderate growth outlook for the industry is expected keep the capital expenditures flat at historical levels and promote more joint ventures for output expansion.

The semiconductor industry has more than 80% of its revenue coming from international markets and China accounts for nearly 40% of the total revenue. This makes the industry overtly indexed to China and the global economy. The macroeconomic cues of the Chinese economy will influence the demand for smartphones and other electronic devices in that market and hence should be constantly monitored for continued weakness. China’s GDP is expected to grow at 6.3% in 2016(15) and any trend that can jeopardize that growth estimate will impact the sales revenue of the semiconductor industry as well. With such a high exposure to international markets, the strength of the US dollar will negatively impact earnings of companies headquartered in US. The promise held by the increasing demand for IoT and big data applications are the main drivers for recommending an overweight rating for the semiconductor industry. Big data and its analysis will strongly benefit firms that have strong memory and/or processor product portfolios. Sensors find themselves as one of the fundamental blocks that will power IoT. Hence the 3 fold increase expected in IoT sales between 2015 and 2020 will augur well for semiconductor firms that have strong sensor based products in their offerings.

INDUSTRY ANALYSIS

The Semiconductor industry is an aggregation of companies involved in the design and fabrication of semiconductor devices and parts. These devices can be classified broadly into 3 major categories: Memories, Processors, Standard and Application Specific Integrated Circuits (ASIC). These devices are a core component of electronic design and provide vital inputs for products and systems ranging from wearables to telecommunication systems.

Memories

Semiconductor memories refer to physical devices that enable data storage on electronic devices. There are many different types of memory storage including SRAM (static random access memory), DRAM (dynamic random access memory), and permanent storage memories such as hard disk drives and flash storage memories.

The growth in market demand for PCs and smartphones is expected to decelerate in 2016 and 2017 and this portends to flat revenue expectations from memory components till 2017.

There is expected to be a growing demand for flash based memory systems as these memory systems provide the enabling storage technology for data analytics and cloud storage solutions. Flash based Storage Class Memory (SCM) systems are expected to be widely adopted for real time data analytics applications, transactional and high performance computing. It is estimated that the market opportunity for these SCMs would be $9-12bn/year in the next 3-5 years. (4) The chart below shows the leading manufacturers of NAND based memories. Among them, Intel Micron partnership and SanDisk HP partnership (27) should be monitored closely as they are involved in the development of the new age storage class memories.
The previous chart represents the leading manufacturers of DRAM memories by revenue. The 2 South Korean companies, Samsung and SK Hynix occupy the top 2 spots. These South Korean firms are expected to maintain their leadership at least for the foreseeable future.

**Processors**

Processors refer to the complex logic circuitry that enable logical computations on data and hence form the brain of electronic devices such as PCs, smartphones, portable computing devices etc. The demand for these end market products positively correlate to the demand for these processors.

The forecast for PCs, tablets, laptops, and smartphones suggest decelerating growth in the foreseeable future and this would hamper the demand for processors as well.
However, the market for wearable technology is expected to grow rapidly and this would cause a spurt in demand for low power processors. Wearable technologies will be discussed further in the industry trends section of this report.

The smartphone processors built by Qualcomm, Apple, and MediaTek all use ARM cores to build their processor chips. The demand for smartphones is expected to grow at 5.3% CAGR through 2019 and ARM is strongly levered to this growth. The PC processor market is dominated by Intel and the decelerating growth in the PC market portends a flat sale outlook for PC processors.

**Integrated Circuits (ICs)**

Integrated circuits refer to both analog and digital circuits that are built either for standard applications or for specialized applications. These IC’s are often produced in huge batches and the margins on these ICs, especially for the standard ICs depend on volume. The demand for standard ICs is determined by end market demand for electronic devices. Application specific ICs (ASICs) are more profitable than standard ICs as unlike standard ICs, ASICs are not commodity products.

Forecasted CAGR growth rates suggest that outside of the traditional electronic devices categories, Internet of Things and Wireless Networks would contribute significantly towards the demand for standard and application specific ICs.

Modern ASIC that includes entire microprocessors, memory blocks, and other building blocks are terms as System on Chip (SoC). SoCs are often designed as standalone systems to achieve complex functionalities. SoC demand is also inextricably intertwined with demand drivers that were discussed for ASICs.

**ETF Analysis**

SPDR S&P Semiconductors (XSD) is an ETF that has exposure only to semiconductor companies.

After experiencing significant period of inflows during 2014, 2015 witnessed outflows for nearly 75% of the year.
Considering that the growth for PCs was tepid during this period, the outflows are not entirely unexpected.

48 Month Performance

Consensus estimates suggest 3-5 year EPS growth at 12.03% for the holdings comprising of the XSD ETF. (13) The SPDR S&P 500 (SPY) ETF has a consensus projected 3-5 year EPS growth of 10.34 %.(12) The forecasts for the respective ETFs suggest a positive outlook for the semiconductor sector.

RECENT DEVELOPMENTS

Gordon Moore postulated in 1965 that the number of transistors incorporated in a chip will double every 24 months. In the 51 years that have passed since, the number of transistors in a chip have increased by a factor of $2^{31}$. This roughly translates to 2 billion times more data handling capability since 1965. In recent years, there is a growing sense that the industry can no longer keep up with Moore’s law. However, recent developments suggest increased R&D spending by semiconductor companies that push for cost effective solutions to ramp up device yield. These solutions, if successful, will help to keep pace with Moore’s Law.

3D XPoint

Intel and Micron announced a new non-volatile memory technology named 3D XPoint that claims to be 1000 times faster than traditional NAND based flash memory systems. 3D XPoint is a Storage Class Memory that drives cloud storage solutions. Once this technology sees a commercial release and the 1000X claims are benchmarked, there could be big upswing in memory spending by firms wanting to upgrade their storage class memories. (22)

Recent Earnings

<table>
<thead>
<tr>
<th>FY 2015</th>
<th>INTC</th>
<th>TSM</th>
<th>TXN</th>
<th>AVGO</th>
<th>NXPI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actual EPS</td>
<td>2.34</td>
<td>1.86</td>
<td>2.82</td>
<td>8.97</td>
<td>5.61</td>
</tr>
<tr>
<td>Consensus EPS</td>
<td>2.13</td>
<td>1.77</td>
<td>2.65</td>
<td>8.46</td>
<td>5.21</td>
</tr>
<tr>
<td>Surprise History (%)</td>
<td>9.98</td>
<td>5.34</td>
<td>6.55</td>
<td>5.98</td>
<td>7.73</td>
</tr>
</tbody>
</table>

Source: FactSet

FY15 earnings of the top 5 semiconductor companies (by market cap) have been higher than the consensus estimates. Surprise history is defined as the % difference between actual EPS and the consensus EPS. According the FY15 earnings, Intel has the highest surprise history. In absolute terms, Avago beat consensus by 51 cents. Once the synergies of the Broadcom Avago merger start materializing, both the bottom line as well as the top line growth for Avago will see significant upward swings. Consensus estimates for 5 year CAGR revenue growth is 18.25%. Given Avago’s track record of consistent surprise history, the actual revenue and income growth can be much higher.

INDUSTRY TRENDS

The demand for semiconductor products are closely intertwined with the demand for its end market electronic products. The likely growth in demand for PCs, smartphones, laptops, and tablets have been discussed in the industry analysis. This section of the report will focus
on rapidly growing segments that potentially will be the future accelerators of growth for the semiconductor industry.

**Wearable Technology**

Wearables represent the electronic devices that are worn on the body or are embedded in clothes and accessories. These wearables act as minicomputers continuously gathering and processing information. The data that is collected is transferred wirelessly to other devices such as smartphone or tablet through Bluetooth.

Wearables require processors that have extremely low power dissipation footprint and the 3X forecasted growth (2015-2018) in the number of wearable units sold will translate to roughly 80 million units of demand for low power processors and other low power ICs.

**Internet of Things (IoT)**

IoTs include every product that involves a sensor, a microprocessor, and a chip that ensures data collected can be transferred across devices. The IoT market forecasted to grow at 23% CAGR from 2015-2019 and this will translate to increased demand for low power ICs.

This strong leverage enjoyed by the semiconductor industry to the growth of the consumer discretionary electronics segment suggests a potential for strong future growth of the semiconductor industry.

**Big Data Paradigm**

Companies Levered to Big Data

Data Growth – A Self Perpetuating Dynamic

Source: Statista

Source: Google Images, Company data, Credit Suisse
The charts above demonstrate the business model that the semiconductor industry has established around Big Data. The semiconductor companies have a product portfolio that aid in data creation, data transmission, and data analytics. Sensors help in data collection and creation. This data can then be transferred using either using wireless techniques to electronic devices such as smartphones, tablets, PCs, or in some cases directly to the cloud. Once the data is collected and stored, computing resources need to be expended for data analytics. This shows how the semiconductor industry is linked to the Big Data growth. With an expected growth of 10% CAGR in Big Data and Big Data applications, the memory segment of the semiconductor seems poised to benefit first from this rapid data growth. With the potential Big Data applications being as diverse as the human imagination, this 10% growth predicted for Big Data will benefit a broad spectrum of the semiconductor industry.

**INDUSTRY COMPETITION**

The high startup capital costs and the technical expertise needed to become an Integrated Device Manufacturer (IDM) raises significant barriers to entry in the semiconductor industry. For those firms who chose to operate as fabless entities, the competition for profitability is more in terms of product differentiation than in terms of volume and economies of scale.

The Porters 5 forces analysis suggests that the underlying competitive landscape is shaped the most by the nature of the competitive rivalry depending on the segment that the firm is operating in. If the segment is dominated by few major players, then the competitive landscape is determined by product differentiation.

For ASICs, the functionality and the quality of the product determines competitive advantage while a product line such as the standard IC would be more dependent on cost differentiation. Since product differentiation and cost both influence the inherent profitability of the industry, a significant portion of the costs incurred by the firm is towards R&D for product and process improvements.

R&D Expense is seen to command a bigger share of the cost pie outside of the Cost of Goods Sold and this indicates a trend in the industry to invest heavily in R&D to keep pace with Moore’s law.

The firms operating in the semiconductor industry do not sell directly to the end market users of PCs and tablets and instead sell their products to large Original Equipment Manufacturers (OEMs) or Original Design Manufacturers. This B2B nature of their marketing strategy is the reason for the marketing and advertising costs being way lower than their R&D expenses. For companies such as TSMC, their marketing expenses are 10 times lower than their R&D expenditure.
Only 16% of the sales for the semiconductor companies come from the US and this indicates an overt reliance on the health of the world economy. China accounts for 40% of the total sales and this makes the health of the semiconductor industry dependent on the health of the Chinese Economy. On a consumption basis, China represents nearly 20-30% of the semiconductor demand and that forms a significant chunk of the end product demand. Recent volatility in the Chinese markets signal a threat to the revenue stream of the semiconductor companies. The turbulence in the Chinese economy should however be weighed against the $161 billion investment planned by the Chinese government to shore up the indigenous semiconductor manufacturing facilities. This planned expenditure suggests that the semiconductor companies, especially the IDM’s would need to either enter into joint ventures or licensing agreements with their Chinese counterparts to maintain their presence in the Chinese market. With almost half their sales revenue coming from China, the semiconductor companies would have to get onto the proposed capex bandwagon to avoid losing market share to their Chinese rivals. (23)

An important theme that permeates the semiconductor industry is that of consolidation through M&A activities. As of October 2015 alone, the year to date value of M&A deals jumped to $67.2 billion on 57 announced transactions. This is 8 times higher than the deals witnessed in 2012. (3) The historically high M&A deals have been fueled to a large extent by the near zero fed fund rates that pulled down to the cost of debt. This frenetic consolidation activity has been driven by slow growth rates to sales that forced companies to broaden their businesses through acquisitions and mergers. The increasing R&D costs due to the need to constantly upgrade and move to advanced nodes has driven companies to become bigger and grow sales at higher rates. Western Digital’s announcement in Oct 2015 to acquire SanDisk is another example of the consolidations taking place in the semiconductor industry. (24)

**Key Semiconductor M&A deals in 2014-2015**

<table>
<thead>
<tr>
<th>Deal</th>
<th>Market segment</th>
<th>Major reasons(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intel-Altera</td>
<td>Computer</td>
<td>Technology/Portfolio gap closure</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Access to new markets/customers</td>
</tr>
<tr>
<td>NXP-Freescale</td>
<td>Automotive, Consumer, Analog and Mixed Signal</td>
<td>Technology/Portfolio gap closure</td>
</tr>
<tr>
<td>Anoge-Broadcom</td>
<td>Communications (Mobile and IoT), Analog and Mixed Signal</td>
<td>Access to new markets/customers</td>
</tr>
<tr>
<td>Infineon-RT</td>
<td>Power Electronics</td>
<td>Technology/Portfolio gap closure</td>
</tr>
<tr>
<td>Intel-Axxin</td>
<td>Networking</td>
<td>Access to new markets/customers</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Technology/Portfolio gap closure</td>
</tr>
<tr>
<td>ADI-Fittke</td>
<td>Analog and Mixed Signal</td>
<td>Technology/Portfolio gap closure</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Increased Market Power to Drive Pricing Advantages</td>
</tr>
<tr>
<td>Cirrus-Wilson</td>
<td>Analog and Mixed Signal</td>
<td>Access to new markets/customers</td>
</tr>
<tr>
<td>RMD-Tiqint</td>
<td>Communications (Mobile)</td>
<td>Increased Market Power to Drive Pricing Advantages</td>
</tr>
<tr>
<td>Qualcomm-SRS</td>
<td>Communications (IoT)</td>
<td>Access to new markets/customers</td>
</tr>
<tr>
<td>Cypress-Spanion</td>
<td>Consumer, Automotive</td>
<td>Increased Market Power to Drive Pricing Advantages</td>
</tr>
</tbody>
</table>

Source: PsAnalysis
Peer Comparisons

<table>
<thead>
<tr>
<th></th>
<th>INTC</th>
<th>TSM</th>
<th>TXN</th>
<th>AVGO</th>
<th>NXPI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sales (B)</td>
<td>55.4</td>
<td>26.6</td>
<td>13.0</td>
<td>6.8</td>
<td>6.1</td>
</tr>
<tr>
<td>Market Cap (B)</td>
<td>145.4</td>
<td>111.6</td>
<td>53.59</td>
<td>38.1</td>
<td>27.3</td>
</tr>
<tr>
<td>Gross Margin (5 yr avg) (%)</td>
<td>61.7</td>
<td>62.6</td>
<td>63.3</td>
<td>59.4</td>
<td>61.6</td>
</tr>
<tr>
<td>P/E (5 yr avg)</td>
<td>12.9</td>
<td>14.1</td>
<td>19.8</td>
<td>31.1</td>
<td>13.2</td>
</tr>
<tr>
<td>Debt/Equity (5 yr avg)</td>
<td>23.9</td>
<td>15.2</td>
<td>36.3</td>
<td>50.3</td>
<td>347.1</td>
</tr>
<tr>
<td>DOI (5 yr avg)</td>
<td>76</td>
<td>45</td>
<td>104</td>
<td>60</td>
<td>97.5</td>
</tr>
<tr>
<td>International % of revenue</td>
<td>82.0</td>
<td>32.8</td>
<td>88.0</td>
<td>89.0</td>
<td>93.0</td>
</tr>
</tbody>
</table>

Source: Factset, Mergent

Gross Margin

The gross margin percentages reveal the premium that a firm can charge over the product cost. Intel with its differentiated product line along with the vertical integration that it enjoys being an IDM leads its peers in terms of the premium that it charges for its products.

The 5 year average gross margin of these peer firms is over 40% suggesting that the firms have favourable long term economics helping it sustain the margins. However, the comparison along gross margins between IDMs and fabless firms that license their IPs will be skewed as firms licensing their technology do not incur fabrication costs. These IPs are used by other designers involved in ASIC/SoC design and they’d be the ones paying for the fabrication costs. ARM Holdings (ARMH) is an example of a firm that licenses its IPs and its 5 year average gross margin is 92.64%. ARM is the market leader in providing technology that forms the core for low power processors. These low power processors are found in smartphones, tablets, and other battery powered low power electronic devices. The graph below represents the growth that ARM has seen in the processor space over the years. This growth has primarily been driven by the low power processor offering from ARM that powers the majority of the smartphones and tablets. The graph also suggests that ARM would become as dominant a player as Intel in computing. Recent trends towards building low power data servers have bought ARM based low power processing technology into the limelight and this is built into the market share forecasts shown in the chart below.

Debt to Equity

The rapid growth forecasted for the IoT segment would require an equal growth in low power processor production and it would be worthwhile to follow the growth trajectory of ARM in the next decade. If ARM based low power processors manage to maintain their stranglehold over X86 based low power processors (Intel Atom), then ARM should see significant appreciation in terms of its market cap. ARM’s current P/E multiple of 43.04, when compared to Intel’s 12.41 foreshadows ARM’s growth potential over Intel.
As discussed earlier in the report, the semiconductor industry has witnessed significant consolidation through M&A activities. All peer companies under discussion are constantly engaging in M&A deals that are in part debt funded. Despite these consolidation activities, the debt to equity ratios are under control. Broadcom LTD (AVGO) is an entity that was formed after Avago acquired Broadcom for $37 billion. The debt to equity is the highest for AVGO among its peers. Avago acquired LSI for $6.6 billion prior to acquiring Broadcom and these deals have increased the debt obligations that AVGO is carrying on its balance sheet. Semiconductor industry is very capital intensive with the approximate cost of building a foundry exceeding $6 billion. The relatively easy access to cheap debt due to the near zero fed fund rates in the US has helped to a great extent in keeping the debt under control. Any future increase in the fed fund rate will impact the consolidation activities and capex increase. It would hence be prudent to track the developments of the fed fund rates.

**Days of Outstanding Inventory (DOI)**

In comparison to its peers, Texas Instruments (TXN) is seen to be carrying inventory the longest. This is however a consistent trend attributable to the consignment accounting for inventory that TXN follows. DOI is seen to be consistent across the peers indicating that the end market demand for the companies has been uniform.

**International Sales**

As discussed in the report before, the semiconductor companies have the majority of their income driven by markets outside of North America. TSMC differs from the other firms in the classification of revenue as it recognizes revenue based on where the customer is headquartered rather than the country of sale. The data points suggest that all semiconductor firms have significant exposure to the trends in the international economies (especially China) and are closely tied to the global GDP growth and not only the US GDP growth.

**ECONOMIC OUTLOOK**

Economic drivers for the semiconductor industry are GDP growth (US, China & Global), unemployment rates, fed fund rates, and strength of the US dollar.
has acquired major firms in the recent years and it currently enjoys a credit rating of BBB on its senior secured debts. Considering that the debt ratings enjoyed by the major semiconductor firms is quite strong as well as the near 0 fed fund rates, debt has been relatively cheaper post the recession years.

Unemployment rates have a negative correlation with semiconductor sales. Increasing employment increases the median disposable income and that correlates positively with spending on consumer discretionary electronics such as smartphones, tablets, PCs etc. The unemployment rate in the US has continued to decline and the Henry Fund team believes that unemployment will settle at 4.9% over the next 2 years.

With majority of the revenue coming from international sales, the strengthening dollar is negatively impacting the earnings of US based companies. Drivers such as potential fed fund rate hikes, Chinese GDP slowdown, and the economic uncertainty in Europe will make the US dollar appreciate further and this would eat further into the earnings of US based companies. A strengthening US dollar however has the advantage of making foreign acquisitions cheaper for US companies.

INVESTMENT POSITIVES

- Despite the modest growth predicted for the PC sales, increased consolidation in the semiconductor industry will drive the top line growth by 2-3% in 2016
- The semiconductor industry is poised to ride the big data growth and the increase in demand for IoT products. These industries are expected to grow at 10% and 23% CAGR respectively in the next decade
- Innovations, especially in memory technology will trigger massive expenditures in memory upgradation. 2018 is expected to be the year when commercially viable memristor based memories will reach the market. These memories are expected to be smaller, denser, faster, and yet have extremely low power footprint when compared to the traditional DRAM and flash based memories

INVESTMENT NEGATIVES

- The semiconductor will experience a slowdown if there are adverse developments impacting the macro economic health of China
- The earnings of the companies in this industry are very sensitive to the strengthening US dollar. Continued appreciation of the US dollar will drive the earnings down

INVESTMENT OPPORTUNITY

The semiconductor industry as a whole is poised for growth in the coming years driven by growth in Big Data and IoT.

Companies in the industry are well positioned to ride the growth opportunities in the end market and increased consolidation in the industry has helped in maintaining a tighter control in cost. The M&A activities have also helped in consolidating the addressable market for the companies

CATALYSTS FOR GROWTH

Innovation would be biggest catalyst for growth in the semiconductor industry. One particular area to watch out for in terms of innovation is the progress made in production of memristor based products. Memristors, by virtue of their ability to retain the information regarding the current that flowed through them in the past can be used for the development of smaller non-volatile memories that have extremely low power dissipation. With the explosion in big data that has been predicted and the conscious effort towards building eco-friendly low power data centers, a breakthrough in making the memristor based memories would spark an increase in IT infrastructure spending
and this augurs well in terms of ensuring a steady top and bottom line growth.

Avago, ARM, and Intel are well positioned in terms of future growth prospects. ARM is the market leader in low power IP segment and is ideally positioned to outpace its competitors in terms of revenue growth. The business model is built around charging upfront fees to license their IPs and then charge royalties based on the number of chips that use the ARM IP. By positioning itself as a fabless design house, ARM has managed to increase its customer base as all other semiconductor companies just buy the IP and integrate it according to the requirements of their design. With a gross margin that is usually greater than 90%, ARM is able to reinvest a lot more money into R&D without needing significant outlays for capex.

Avago technologies with its acquisition of Broadcom has effectively doubled its market cap from $33 billion USD and its EPS is expected to grow between 8-10% in the next 12 months. The Broadcom acquisition deal is expected to be completed in FY 2016 and the synergies of this acquisition are expected to drive the future growth rate higher. Consensus estimates point to a 18.25% 5 year compounded growth rate and there are no indications in Avago’s target market that dispute the growth rate figure. The estimated forward P/E of 9.89 suggests that stock is undervalued and can be a valuable acquisition to any portfolio. (5)

**KEYS TO MONITOR**

With nearly 40% of sales revenue tied to China, the macroeconomic health of China is an important factor to monitor. Developments that significantly weaken the Chinese growth will impact the revenue growth of the industry.

The data growth paradigm is another facet that needs to be monitored as it is one of the key drivers of growth for the semiconductor industry. Semiconductor industry has the potential to grow at 6-9% CAGR growth in future on the back of big data and IoT and any hiccups to the growth of these drivers will hamper the long term growth prospects of the industry. (4)

**REFERENCES**

4. Credit Suisse Sector forecast for Semiconductors: “2016 Outlook - In Like a Lamb, Out Like a Lion”
5. FactSet and Mergent for all financial data of INTC, TSM, TXN, AVGO, and ARMH
10. Semiconductor NEC Market cap information: https://www.google.com/finance?catid=us-TRBC%3A5710101010&sort=MARKET_CAP&ei=74u2VrHPCoKemAGAp4OQDg
17. ARM Holdings information from Google Finance: https://www.google.com/finance?q=armh&ei=vwS4VrnnD4qHmAGg4IH4Bw
22. 3D XPoint news: https://www.micron.com/about/emerging-technologies/3d-xpoint-technology

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