

# PDV *OBSERVATIONS*

A Quarterly Newsletter for PDV Clients and Friends

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## Micron Technology

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You should not sell a stock that has risen a lot if the growth in its business value supports the appreciation and future growth prospects remain attractive. A case in point: Micron Technology, Inc. (“Micron”).

Micron is one of the largest semiconductor memory chip manufacturers in the world. Its products include memory and storage solutions covering all major memory technologies currently available in the industry, and are sold into a variety of end markets for a broad range of applications. In fiscal year (FY) 2017, 64% of Micron’s total net sales came from DRAM products (random access memory devices that provide high-speed data storage and retrieval) and 32% came from NAND products (non-volatile memory and storage devices that retain content when power is turned off).

Micron stock has been on fire. Since beginning of 2016, the stock has appreciated 278%. Despite such a spectacular run, there are many reasons (below) why the stock continues to be attractive.

### **Anchoring from cyclical trough**

Micron stock should never have fallen to where it was at the beginning of 2016. Because Micron operates in an industry with extreme boom/bust cycles, it has a long history of making money during up-cycles, but bleeding heavy losses during downturns. Investors panicked during the most recent industry downturn, driving the stock down to unjustifiably low levels. Part of the stock’s appreciation since then corrects the unduly severe decline.

### **Recent spectacular operating results**

The current memory chip boom began in mid-2016 and continues to this day, thanks to robust demand from smartphones and data servers, as well as tight supply. Favorable market conditions and operational efficiency contributed to Micron’s high profitability throughout its FY 2017 and the first half of FY 2018. In the DRAM segment, Micron experienced improved average selling price per gigabit, better product mix, and lower manufacturing cost. In the NAND segment, Micron was able to reduce manufacturing cost more than the decline in average selling prices per gigabit.

Micron’s strong profitability has resulted in robust free cash flow, which went from negative in FY 2016 to \$3+ billion in FY

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2017. With ample free cash flow, Micron has been reducing its debt, which was at one time as high as \$12.4 billion due to its acquisition of Inotera. But as of the end of FY 2018 Q2, its debt level was lowered substantially to \$9.3 billion. The company announced in May that it is expecting to use its free cash flow from the second half of FY 2018 to further reduce its secured debt and redeem its convertible debt.

### **Same old, same old lack of respect**

Despite the spectacular appreciation over the past 30 months, Micron continues to be undervalued by the market. This is because the memory chip industry has always been very competitive. High cost of building new manufacturing plants makes the business extremely capital intensive. The products have in the past been highly commoditized, which encouraged buyers to seek the lowest price memory chips available. To gain market share, manufacturers were prone to engage in price wars. Furthermore, due to the economics of the production plants, manufacturers were motivated to maximize output regardless of demand; any slowdown in demand quickly led to oversupply. Manufacturers often had to cut prices to move inventory during a downturn and under-invested in production capacity until demand caught up, which in turn led to a supply crunch. These boom-and-bust periods have occurred many times throughout the industry's history.

So investors are reluctant to give the company a higher (more appropriate) valuation, because they expect the next industry downturn to be around the corner. In the past, the stock prices of memory chip manufacturers started dropping ahead (and in anticipation) of imminent industry downturns; such price declines have been huge over the course of the down-cycle.

### **This time is different**

This time is different (aka "TTID") are 4 of the most dangerous words in finance. Nevertheless, we do think TTID when it comes to the memory chip industry. This is because a number of very significant factors have emerged which shift the supply/demand dynamics in favor of higher profitability and growth, as well as longer and less volatile industry cycles. We explain these factors below.

#### ***Supply***

In the past, the cyclical nature of the memory chip business has resulted in bankruptcies and significant consolidation within the industry, reducing the number of memory chip suppliers from 20+ to a handful. Currently, the memory chip industry has 2 major segments: DRAM and NAND. Major competitors within the DRAM segment are Micron, Samsung, and SK Hynix. For the NAND segment, there are Intel, Micron, Samsung, SK Hynix, Toshiba, and Western Digital.

These remaining major suppliers have become more disciplined with their capital expenditures, focusing more on technology transitions than capacity expansion. For instance, both Samsung and SK Hynix cut back on their capital investment in 2016 in the midst of DRAM oversupply. Further, the cost and technological complexity of adding new capacity today are substantially higher. Even if manufacturers increase their capital spending, production capacity would not grow as much

as in the past. These trends all point to greater stability in supply growth going forward.

Investors also worry about the potential supply from Chinese manufacturers, but that will have limited effect on the industry in the short to medium term. First, China currently lacks the intellectual property (“IP”) to develop DRAM and NAND. Existing main IP holders are very reluctant to share/license their IP with new market entrants. Second, China’s attempt to resolve the IP issue through acquisitions has so far been unsuccessful. The U.S. government is intently focused on protecting U.S. memory chip IP, due to national security concerns. Third, even if Chinese manufacturers succeed in acquiring the appropriate IP, they lack the technological know-how to keep up with the industry’s high rate of technology transition (Micron’s CFO Ernie Maddock noted in the Bank of America Merrill Lynch 2017 Global Technology Conference that currently the DRAM industry transitions to a new technology about every 1.5 years and the NAND industry transitions to a new technology about every 1-1.5 years). All these factors pose significant challenges to the Chinese manufacturers, especially in the higher-end memory chip segments, despite unlimited capital from their government in support of their ambitions.

### *Demand*

Memory chips used to be largely driven by growth in personal computers. In recent years, the explosion in data consumption—ranging from media content consumed by individuals to data analytics demanded by businesses—has broadened the source of memory chip demand far beyond the personal computer market.

Going forward, memory chip demand will likely come from more diversified end markets. Besides smartphones, which will likely continue to be packed with higher resolution cameras and displays, cars are being built with increasingly data-intensive features (e.g. streaming of traffic alerts, lane assistance, and high resolution infotainment display). Micron noted in its 2018 Analyst & Investor Event that memory consumption in the automotive segment could grow substantially as cars move to full autonomy.

Continuing development in other AI-related services will require much more memory and storage in the data centers. According to Micron at its 2018 Analyst & Investor Event, AI-capable servers require 6 times the amount of DRAM and 2 times the amount of SSDs (solid-state drives, which mostly use NAND memory and are quickly displacing hard disk drives in data centers) compared to a standard server. Since only a very small percentage of servers today are AI-capable, this segment is potentially another major demand driver going forward for Micron’s products.

In addition, as wireless technology continues to advance (e.g. 5G) and facilitate greater adoption of Internet of Things, more devices—from home appliances to industrial machines to city infrastructures—will be connected. The massive volume of data to be exchanged and processed among these devices will significantly raise the amount of high speed memory required in the end devices as well as the data centers.

Since these secular trends diversify the revenue source for memory chip suppliers, a temporary demand decline in a particular end market should not have an outsized, negative effect on a supplier’s overall profitability.

### *Transforming from commodity to specialized solutions*

In addition to more favorable supply/demand dynamics, end markets are becoming more data-driven, demanding increasingly specialized high-performance memory solutions that are more profitable and generate higher margins for Micron. This provides significant opportunities for technologically leading memory chip suppliers like Micron to move away from supplying commoditized products in favor of providing customized system solutions. Being able to offer specialized, advanced memory and storage solutions will also enable Micron to become less susceptible to the industry's cyclical nature.

For instance, as a vertically integrated supplier of SSDs, Micron designs and manufactures the SSDs from start to finish. This not only gives Micron a cost advantage that can be passed onto the customers, but also allows Micron to ensure product quality (from testing of the product to designing firmware optimized for the memory components, etc.). The end result is that Micron is able to offer a high-value SSD portfolio.

Similarly, in the automotive segment Micron has a comprehensive automotive memory portfolio that meets rigorous qualification requirements, i.e. suitable for high temperature applications, reliable, and meets qualification across the end product's entire supply chain. It offers industry-leading solutions, such as the highest speed automotive grade LPDDR4 (a type of DRAM). Micron's ability to offer high quality product and reliable supply also helps the company to differentiate itself, since automotive customers care a great deal about the quality and reliability of supply.

### **Other value-enhancing initiatives**

Micron should remain solidly profitable as long as it can reduce manufacturing costs at a faster rate than declines in average selling prices. According to Micron's CFO Eddie Maddock at the Stifel 2017 Technology, Internet and Media Conference, Micron was able to reduce costs by an annual rate of 15-25% for DRAM and 25-30% for NAND over the most recent two fiscal years through more advanced technological manufacturing. Micron stated at its 2018 Analyst & Investor Event that it expects additional cost reductions going forward.

Micron also showed confidence in sustaining and improving on its recent stellar operating results by announcing a \$10 billion share repurchase program, which it will initiate in FY 2019.

Despite the huge run in the stock price over the last 30 months, Micron's stock is still undervalued. Micron's stock should rise further from the current levels when the market recognizes that the memory chip industry dynamics have changed for the better and Micron is in a position to benefit from the secular growth drivers discussed above.