

Semiconductor Cycle Analysis and the Outlook for Renewed Revenue Growth What Will Drive the Next Growth Cycle?

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The semiconductor industry started its most recent revenue growth cycle as annualized revenue growth started to improve after reaching a low point in June 2016. At this point annual revenue growth had fallen to -4.8%. Driven heavily by strong increases in DRAM and Data Flash pricing, total annual semiconductor revenue growth reached a peak of +22.4% twenty months later in January 2018. Annualized revenue growth has been weakening for the past sixteen months as the semiconductor industry comes down the back side of the cycle. Once again, memory pricing has played a major role in the magnitude of the swings in the semiconductor cycle. However, all major component categories have been generally aligned in following the same growth pattern. By May 2019 worldwide revenue growth had just dipped slightly negative at -0.3% annual growth. Quarter-over-quarter growth fell to -14.6% in May 2019. The data presented in Figure 1 illustrates the most recent semiconductor revenue growth cycles based on detailed reports from the World Semiconductor Trade Statistics (WSTS) industry association. As shown in this figure, the growth cycle continues to trend downward.



Figure 1 – Recent Worldwide Semiconductor Revenue Growth Cycles

Source – World Semiconductor Trade Statistics (WSTS)



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Key questions that electronics components supply chain executives need to answer are, "When will this current cycle end?" and "When will the industry see a return to positive growth?" The answers to these questions will form the foundation for management of product orders and inventory levels. Of course, planning must take place at the granular, individual product level. However, understanding the profile of the overall semiconductor market provides a foundation for the timing of more detailed decisions and actions that need to be taken in order to meet customer demand while balancing inventories.

Analysis of historical semiconductor industry patterns can provide insights that will help set expectations for future growth. Expectations for growth must also be based on an understanding of market and technology forces that will drive future demand.

<u>Analysis</u>

Figures 2 and 3 present the quarter-to-quarter semiconductor revenue growth for the fourth and first quarters going back to 1978. The decline in Q4 2018 semiconductor revenue was the worst in history with the only exception being the collapse in revenues caused by the financial crisis in Q4 2008. The revenue contraction in Q1 2019 was the fourth deepest percentage drop in history. The dramatic revenue declines in Q4 2018 and Q1 2019 mirror the steep declines of a decade earlier in Q4 2008 and Q1 2009. However, the forces driving these deep declines are very different with the earlier decline driven by economic/financial forces. The current fall in revenues is taking place in a period of strong economic performance and consumer/market confidence.



Figure 2 – Q3 to Q4 Growth Rates for Total Semiconductor Revenue

Source – World Semiconductor Trade Statistics (WSTS)







Source – World Semiconductor Trade Statistics (WSTS)

The disconnect between the semiconductor cycle and economic cycle is notable given the alignment between the two cycles for over twenty years as shown in Figure 4. As the semiconductor industry has extended its reach globally and magnified its influence with its penetration of the very fabric of individuals, societies and corporations, the interacting forces between the semiconductor industry and the global economy have resulted in patterns of growth that have aligned key turning points. The alignment between economic GDP growth and electronics/semiconductor growth is seen beginning in the late 90s as the expanded global influence of computing and communications products reached a key threshold. While the size of growth differs, the peaks and valleys started to align. This connection has been strengthened in subsequent years as wireless/mobile communications and the internet have become pervasive around the world.

It is interesting to note that the turning points in semiconductor/electronics growth have become a leading indicator over the past ten years of changes in economic growth. One theory to explain this behavior is that supply chain management practices have been refined in the electronics industry so that production and purchasing is much more sensitive and responsive to changes in economic health. As a result, the electronics industry responds to changes in the economy faster than the combined industries that shape total economic growth. While there is great caution among economists regarding the strength of future economic growth, the consensus outlook for the economy is relatively stable as shown by the forecast from IHS Markit Global Insights presented in Figure 4. Hopefully, the decline in the semiconductor cycle will truly disconnect from the overall economy this time or semiconductors will get back on track with a good economy!

Recent cycles have shown that the economy is typically a negative force in the growth of the semiconductor cycle. Growth in semiconductors typically requires a stable economic



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environment and key market/technology drivers. A weak economy can undermine and harm growth in the electronics industry in spite of healthy direct technology/market forces.





Source – IHSM Global Insight and IHSM Technology

Since WSTS began measuring and reporting data on the semiconductor industry in 1978 there have been 10 annual growth semiconductor cycles, including the current cycle, that can be identified. Figure 5 shows the pattern of these cycles over the four-year period following the start of the cycle with all cycles shown with a common beginning point. Each cycle has its own unique shape but there are some common elements. For example, Table 1 shows the length of each cycle. The average cycle length for previous cycles has been 52 months. However, this is skewed by the extra long June 1990 cycle that lasted 82 months. Excluding that cycle, the average cycle has lasted 48 months. From the start of the current cycle in June 2016 to the latest reported data for May 2019 it has been 36 months. Based on averages, this current annual cycle could be expected to last another 12 months. The shortest cycle lasted 37 months. However, the current trends clearly show that this cycle will not end in one more month. However, the quarter-over-quarter cycle shown in Figure 1 shows definite signs of turning and it would be reasonable to anticipate this quarterly cycle could turn in two to three months, around August 2019. History shows the annual cycle turns up around six to seven months following the turn of the quarterly cycle. Based on this analysis, the current annual cycle would end in approximately 10 months, or March 2020. This would result in positive growth for the full year of 2020. The current IHS Markit Technology group forecast projects the semiconductor market will decline by 12.5% in 2019 and return to growth of 5.5% in 2020. A return to positive guarter-



over-quarter growth could be expected as soon as the first quarter of 2020 based on analysis of cyclical semiconductor patterns.



Figure 5 – Comparison of Annual Semiconductor Revenue Growth Cycles

Source – World Semiconductor Trade Statistics (WSTS)

Table 1 – Annual Semiconductor Cycle Lengths and Beginning Point of Recovery

										Average	Current
										Cycle	Cycle
Recovery Start Date	Jan '78	Feb '82	Jan '86	Jun '90	Mar '97	Mar '02	Feb '06	Sep '09	Sep '12		Jun '16
Recovery Starting Growth Level	11.6%	-8.2%	-18.8%	-1.2%	-13.9%	-36.8%	5.1%	-19.7%	-4.8%	-9.6%	-4.8%
Cycle Length (Months)	48	48	54	82	61	48	44	37	47	52	36+

Source – World Semiconductor Trade Statistics (WSTS)

Figure 6 presents total annual semiconductor revenues beginning with \$3.9 billion by January 1978 and peaking at almost \$472 billion in trailing 12-months revenue in November 2018. The green line in this figure shows a long-term growth trend that started in 2005. While revenues have been cyclical, they have tended to revolve around this long-term trend line. In the current cycle, the strong price increases in memory pushed revenues far above the trend line. However, the strong downturn that has started would appear to return revenues back to this long-term growth line by early 2020. The slope of this long-term trend line represents approximately 3 percent growth in the semiconductor industry. This level of growth represents a more mature industry in terms of overall growth. However, the magnitude of the swings in the industry cycles represent an industry of greater variability and risk. Aggressive management of production and inventories through these cycles is key to minimizing the level of risk for supply chain participants.





Figure 6 – Worldwide Annual Semiconductor Revenue

Source – World Semiconductor Trade Statistics (WSTS)

The quarter-over-quarter growth for each of the major regions and worldwide is shown in Figure 7. The wider swing in growth for the Americas region stands out. This much stronger growth and decline in the Americas is due to the much larger share of Americas revenue attributed to memory products, specifically DRAM and Data Flash. By the end of 2018, memory accounted for over 50% of Americas semiconductor revenues. Of course, this means the Americas revenue swings will follow more closely the volatile swings in memory ICs. However, on a global level, memory ICs have increased their share of the total semiconductor market dramatically over the past five years. By 2018, memory ICs represented 34% of global semiconductor revenues, nearly double its share of 17.9% in 2012. The current decline in the market is clearly a "correction" driven by the DRAM and Data Flash price reductions. In fact, quarter-over-quarter revenue growth has already returned to the discrete component, optoelectronics and sensors & actuators categories.

As noted at the beginning of this analysis, electronics and semiconductor growth rely on market and technology forces. As we anticipate the start of the next cycle there is strong optimism for improved growth. The timing of development for three major technologies aligns in the 2020-2022 time period. It is expected that 5G, IoT and Cloud technologies will come together to drive new product and market opportunities as well as reshape the features and designs that consumers and businesses will demand. This means that the next cycle will be driven by adoption of exciting technologies across a wide range of products and markets as well as the upgrading of a significant portion of products in the "installed base." The synergies between these exciting technologies (and others) should stimulate strong growth prospects for electronics and semiconductors in 2020 and beyond.





Figure 7 – Quarter-over-Quarter Semiconductor Revenue Growth by Region

Source – World Semiconductor Trade Statistics (WSTS)



Figure 8 – Memory ICs as a Percent of Total Semiconductor Revenue



Source – IHSM Technology

<u>Action</u>

- Supply chain participants should plan for renewed quarter-over-quarter growth by the first quarter of 2020. Product orders and inventories should be managed in expectation of renewed demand. Non-IC semiconductors have already returned to growth. Memory ICs will likely be the last category of products to see renewed revenue growth. However, unit shipment growth in memory ICs will increase sooner.
- The economy should be monitored closely for signs of weakness. If there is a major shock to the economy such as a major regional conflict or rapid escalation in trade disputes, GDP growth could be harmed. As noted in the analysis, the economy typically plays a role in undermining growth in the electronics and semiconductor industries. If there is an economic downturn it will weaken growth in the next cycle.
- It should be expected that many products will be redesigned as they adopt new technologies to enable exciting new features. These redesigns will likely alter the mix and value of components in a wide range of products. Suppliers should analyze the anticipated changes in designs and component demand profiles in the markets they serve.
- The need to continuously manage a cyclical market will be a constant in the electronics and semiconductor industry moving forward.