Memory Trends in the Semiconductor Industry

The semiconductor industry has seen significant growth over the last 8 quarters. The industry went from $80B to $115B in quarterly sales from Q116 to Q417. This represents a huge rebound from the preceding 8 quarters (Q114 to Q415) which represented a prolonged decline. All regional markets also grew with US leading the way at 35%, APAC growing 19%, EMEA at 17% and Japan at 13.6%. A closer look to understand the growth trend reveals interesting market dynamics for the component technologies. While all the component technologies experienced year-over-year growth, the growth rate of memory technologies represented 5-7× the growth of other technologies at approx. 60% YoY (growth driven by demand and ASP increases). Stripping out memory growth shows that all regions grew at a modest 9.5-10.5%. In essence, the overall semiconductor market has been buoyed by the dramatic growth in memory sales.

Clearly the increases in the overall semiconductor market in 2017 are being fueled by the digital revolution we are experiencing. More specifically growth in semiconductor content in automotive sector, demand for more powerful computing infrastructure in datacenters, widespread proliferation of consumer electronics and the industrial internet of things are big generators of demand for semiconductors in general and memory components in particular.

In this trends article, we examine the drivers of the growth in the memory market and go deeper into the trends by technology types.

Memory Types and Market Sizes in 2017

Memory components represent 30% of overall semiconductor market worldwide and amounted to $124B in sales in 2017. Semiconductor Memory refers to a plethora of electronic data storage devices that find application as computer memory in traditional computers (PCs, laptops), consumer devices (phones, cameras), commercial IT applications (Datacenters, Telecom), traditional industrial applications and the emerging spectrum of connected/IoT applications. The memory market constitutes two fundamental technology areas:

- Volatile Memory – memory devices that require power to maintain stored information. The two major types of volatile memory are DRAM (Dynamic RAM) and SRAM (Static RAM). There are many differences in usage, speed, capacity, cost, etc. between these memories. These differences occur due to the difference in the technique which is used to hold data. DRAM makes use of a single transistor and capacitor for each memory cell, whereas each memory cell of SRAM makes use of an array of 6 transistors. DRAM needs refreshing, whereas SRAM does not require refreshing of the memory cell.
- Non-Volatile Memory - memory devices that can retain stored information even without power. Examples of non-volatile memories include Flash (NAND and NOR), EEPROM (Electrically Erasable Programmable Read-Only Memory), EPROM (Erasable Programmable Read-Only Memory), etc. Flash memory is a type of EEPROM, with a simpler structure. Data can be erased in blocks, it is significantly easier to manufacture over volatile memory and has much larger densities.

Flash memory devices use two different logical technologies—NOR and NAND. NOR flash provides high-speed random access, reading and writing data in specific memory locations; as little as a single byte can be retrieved. A NAND flash reads and writes sequentially at high speed, handling data in small blocks called pages, however it is slower on read when compared to NOR. NAND flash reads faster than it writes, quickly transferring whole pages of data. Less expensive than NOR flash at high densities, NAND technology offers higher capacity for the same-size silicon

The table below summaries the mainstream memory types, their market sizes and the growth experienced in 2017.

Memory Type	Technology	Y2016	Y2017	YoY Growth	% of Total
Volatile	DRAM	$41.2B	$72.80B	76.8%	58.7%
Volatile	SRAM	$0.42B	$0.40B	-3.9%	0.3%
Non-volatile	NAND Flash	$32.0B	$47.2B	47.5%	38.1%
Non-volatile	NOR Flash	$1.67B	$1.9B	16.3%	1.6%
Non-volatile	Mask PROM and EPROM	$0.24B	$0.4B	56.2%	0.3%
Non-volatile	EEPROM	Market size estimate ~0.6B			
Total		$76.7B	$124B	61.7%	

Applications based on Memory Type

The table below highlights key applications areas along with key characteristics for the various memory types.

Type	Computer	Comms	Consumer	Auto	Industrial	Government	Key Technology Characteristics
DRAM	51%	37%	8%	1%	2%	0%	• Volatile memory • High speed (in the 10ns) • High-endurance • Small cell size • Low power consumption
SRAM	7%	23%	4%	15%	48%	3%	• Volatile memory • Very-high speed (in the 5-10ns) • High-endurance • Ver large cell size • Very low power consumption
Flash	49%	31%	16%	2%	2%	0%	• Non-volatile memory • Lower speed (in the 10ns) • Low-endurance • Very small cell size • Higher power consumption
Other	8%	12%	36%	10%	33%	1%	Includes EPROM, Nor Flash and emerging technologies for commercial applications

Growth Forecasts and Expectations for 2018

Analysts forecast another strong year for the Memory and Storage segment in 2018. This, after a 60% growth that the segment posted in 2017. Bill McClean from IC Insights reports, "The big increase in the DRAM market forecast for 2018 is primarily due to a much stronger ASP expected for this year than was originally forecast. IC Insights now forecasts that the DRAM ASP will register a 36% jump in 2018 as compared to 2017, when the DRAM ASP surged by an amazing 81%. Moreover, the NAND flash ASP is forecast to increase 10% this year, after jumping by 45% in 2017. In contrast to strong DRAM and NAND flash ASP increases, 2018 unit volume growth for these product segments is expected to be up only 1% and 6%, respectively."

Application	Approximate Bit CAGR*		Growth Drivers
	DRAM	SSD	
Cloud	40%	60%	• Social media, mobile and IoT drive need for differentiated storage portfolio compared to traditional enterprise architecture design • More diverse workloads driving need for higher performance memory
Enterprise	30%	60%	• Greater use of virtualization and software-defined architectures, requiring a performance-oriented data center infrastructure
Networking	30%		• Faster processing requirements for big workloads • Near-real time analytics from multiple data sources
Graphics	35%		• Adoption of 4K/UHD and other graphics for a variety of enterprise and consumer applications
Mobile	30%	50%	• Increased demand for storage, multi-media usage to continue driving demand
Consumer/ Connected Home	25%	25%	• 4K/UHD increasing STB storage, DTV DRAM & NVM • Smart home/wearables growth increasing mobile NVM+DRAM • AI/natural language assistants integration
Industrial	30%	40%	• Big-data/AI/machine learning increasing processing and storage • IoT end points, edge nodes, IP cameras driving NVM growth • Ubiquitous connectivity increasing M2M module memory
Automotive	35%	30%	• 2× increase of in-vehicle displays with virtual cockpit • 3D navigation maps and black box driving 3-4× storage • 4-5× increase in sensor data and AI/machine learning

* Three-year CAGR from 2017 to 2020

References:

- WSTS
- IC Insights
- Micron
- Wikipedia
- Quora

Online
www.arrow.com/IoT

Five Years Out