
2 THE DRAM MARKET

1996 FACTS

Market Size: \$25,130 million

Shipments: 2,762 million

ASP: \$9.10

1997 FORECAST

Market Size: \$21,485 million

Shipments: 3,064 million

ASP: \$7.01

OVERVIEW

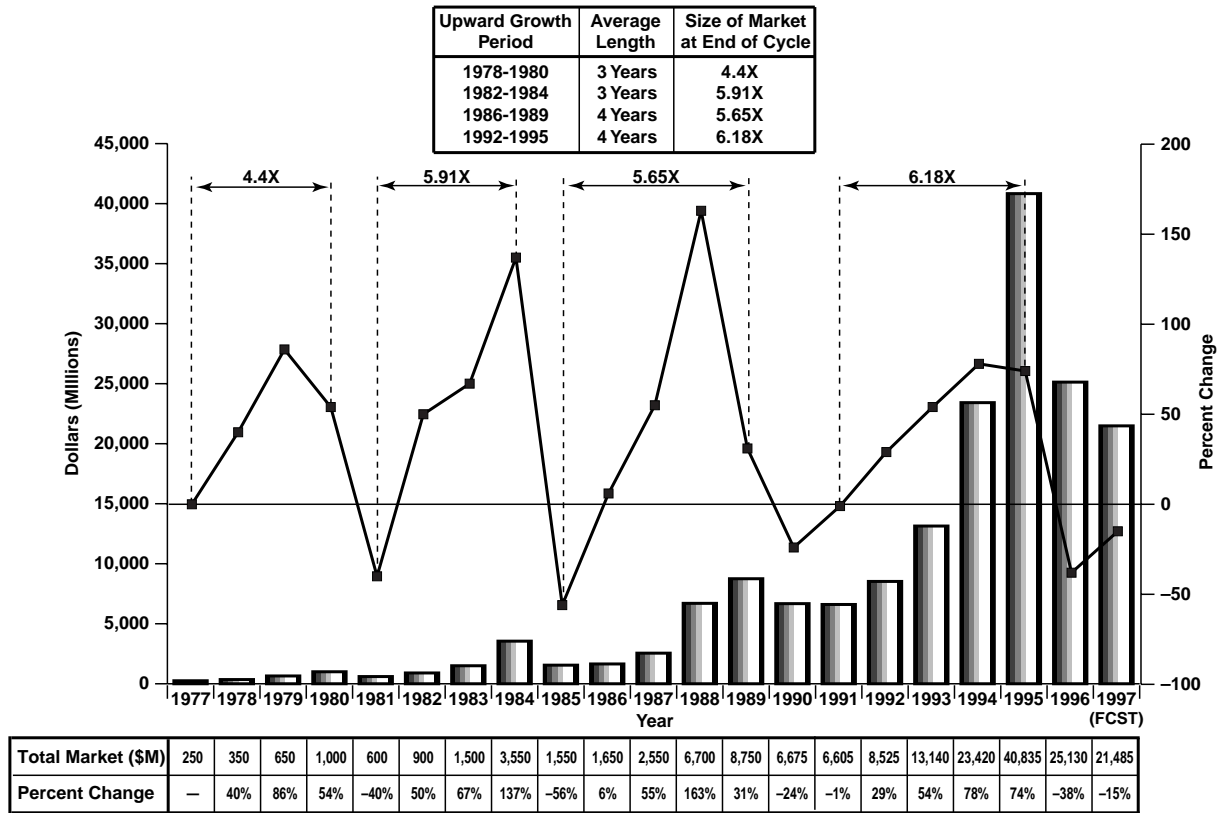
Dynamic random access memory or DRAM is the main memory component of most computers and many electronic systems. From 1993-1995, industry observers were stunned and amazed as the DRAM market displayed relentless growth. Helping the DRAM market grow at its accelerated pace was the lack of sufficient memory production capacity available to meet the needs of the vigorous PC market.

In 1996, a different scenario panned out for the DRAM market and its suppliers. In 1Q96, DRAM prices for 4Mbit devices plunged and continued to drop through the balance of the year. Furthermore, 16Mbit DRAM average selling prices (ASPs) also rapidly declined. Softer PC sales and a rather sudden glut of worldwide production capacity turned the DRAM market from one of the most lucrative to one of most difficult in which to participate.

For 1997, ICE anticipates another soft year for the DRAM market. Although unit demand will remain strong and bit volume will continue to grow nicely, excess capacity will further erode average selling prices. This will keep the market from growing at the rapid pace it experienced just a few years ago.

THE DRAM MARKET

The DRAM market has been through many up and down cycles as shown in Figure 2-1, but few suppliers recalled demand being so strong over such a long period of time as during the recent past few years. For the already huge DRAM market to grow by such large percentages over a several year period was quite remarkable.



Source: ICE, "Memory 1997"

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Figure 2-1. DRAM Market History

However, as the graph shows, good times don't last forever. Excess capacity and plunging average selling prices resulted in a 38 percent decline in the 1996 DRAM market. Following that disastrous year, there is good news and bad news.

The bad news is that ICE forecasts another double-digit decline in for the 1997 DRAM market (-15 percent). Back to back double-digit declines would be a first for the DRAM market. The good news is that recent DRAM market history shows that negative growth has lasted one or, at the most, two years, while positive growth periods have been three or four-plus years in duration. At the end of these growth spurts, the DRAM industry has always greatly increased in size.

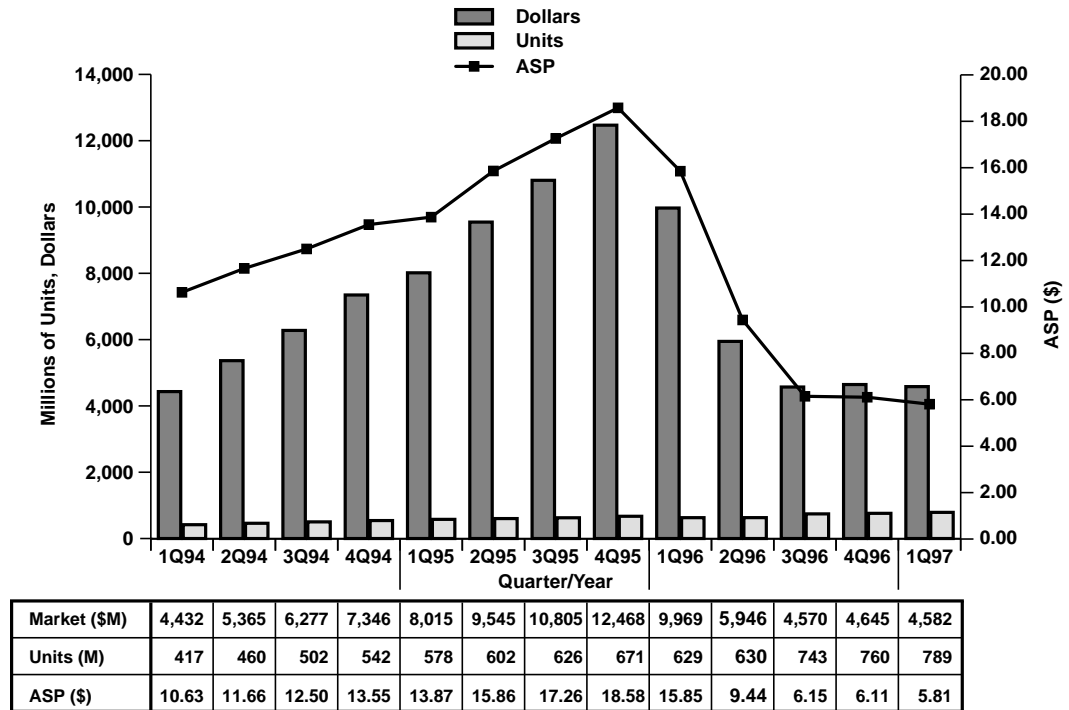
Shown in Figure 2-2 is ICE's complete DRAM market forecast for the 1992-2002 time period. Displayed are the market size, units shipments, ASPs, and price per megabit for several densities. The quarterly DRAM market shown in Figure 2-3 details the strong quarterly growth period in the DRAM market. DRAM manufacturers must look back fondly upon 1994 and 1995 when everything was up, up, up! There was no end in sight to the outstanding growth—until 1Q96. As noted in the chart, average selling prices fell steeply and fell quickly.

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
64Kbit Units (M)	30	4	—	—	—	—	—	—	—	—	—	—
ASP (\$)	1.33	1.45	—	—	—	—	—	—	—	—	—	—
Price Per Mbit (\$)	20.29	22.13	—	—	—	—	—	—	—	—	—	—
Market (\$M)	40	6	—	—	—	—	—	—	—	—	—	—
256Kbit Units (M)	272	197	107	64	32	23	15	—	—	—	—	—
ASP (\$)	1.80	1.70	1.80	2.15	2.00	1.95	2.00	—	—	—	—	—
Price Per Mbit (\$)	6.87	6.48	6.87	8.22	7.63	7.44	7.63	—	—	—	—	—
Market (\$M)	490	335	193	139	65	44	30	—	—	—	—	—
1Mbit Units (M)	827	822	596	500	463	260	187	145	100	45	25	10
ASP (\$)	4.50	3.01	3.10	3.60	3.00	2.85	2.56	2.40	2.30	2.25	2.20	2.25
Price Per Mbit (\$)	4.29	2.87	2.96	3.43	2.86	2.72	2.45	2.29	2.19	2.15	2.10	2.15
Market (\$M)	3,720	2,470	1,848	1,800	1,388	741	479	348	230	101	55	23
4Mbit Units (M)	145	457	776	1,254	1,649	1,498	958	835	615	350	250	125
ASP (\$)	16.05	11.72	11.91	12.00	12.85	5.31	2.39	2.00	1.80	1.65	1.55	1.50
Price Per Mbit (\$)	3.83	2.79	2.84	2.86	3.06	1.27	0.57	0.48	0.43	0.39	0.37	0.36
Market (\$M)	2,328	5,355	9,240	15,048	21,190	7,955	2,295	1,670	1,107	578	388	188
16Mbit Units (M)	0.1	2	20	103	333	974	1,800	2,100	1,750	1,700	1,480	1,200
ASP (\$)	275.00	180.00	93.00	61.85	54.41	16.11	7.39	6.51	5.80	5.25	4.90	4.75
Price Per Mbit (\$)	16.39	10.73	5.54	3.69	3.24	0.96	0.44	0.39	0.35	0.31	0.29	0.28
Market (\$M)	28	360	1,860	6,371	18,135	15,691	13,310	13,671	10,150	8,925	7,252	5,700
64Mbit Units (M)	—	—	—	0.1	0.25	7	103	460	1,300	2,100	2,800	3,000
ASP (\$)	—	—	—	575.00	225.00	100.35	51.94	2,600	16.00	10.00	7.25	6.75
Price Per Mbit (\$)	—	—	—	8.57	3.35	1.50	0.77	0.39	0.24	0.15	0.11	0.10
Market (\$M)	—	—	—	63	56	697	5,371	11,960	20,800	21,001	20,300	20,250
128Mbit Units (M)	—	—	—	—	—	—	—	0.1	4	45	125	100
ASP (\$)	—	—	—	—	—	—	—	405.00	155.70	65.00	33.00	24.00
Price Per Mbit (\$)	—	—	—	—	—	—	—	3.02	1.16	0.48	0.25	0.18
Market (\$M)	—	—	—	—	—	—	—	41	623	2,925	4,125	2,400
256Mbit Units (M)	—	—	—	—	—	—	—	0.1	5	80	375	1,100
ASP (\$)	—	—	—	—	—	—	—	600.00	325.00	140.00	73.00	40.00
Price Per Mbit (\$)	—	—	—	—	—	—	—	2.24	1.21	0.52	0.27	0.15
Market (\$M)	—	—	—	—	—	—	—	60	1,625	11,200	27,375	44,000
512Mbit Units (M)	—	—	—	—	—	—	—	—	0.1	5	15	65
ASP (\$)	—	—	—	—	—	—	—	—	700.00	300.00	155.00	94.00
Price Per Mbit (\$)	—	—	—	—	—	—	—	—	1.30	0.56	0.29	0.18
Market (\$M)	—	—	—	—	—	—	—	—	70	1,350	2,325	6,110
1Gbit Units (M)	—	—	—	—	—	—	—	—	—	—	0.1	12
ASP (\$)	—	—	—	—	—	—	—	—	—	—	700.00	350.00
Price Per Mbit (\$)	—	—	—	—	—	—	—	—	—	—	0.65	0.33
Market (\$M)	—	—	—	—	—	—	—	—	—	—	70	4,200
Total Market (\$M)	6,605	8,525	13,140	23,420	40,833	25,130	21,485	27,750	34,605	46,080	61,890	82,870
Total Units (M)	1,274	1,482	1,499	1,921	2,477	2,762	3,064	3,540	3,774	4,325	5,070	5,612
ASP (\$)	5.18	5.75	8.77	12.19	16.48	9.10	7.01	7.84	9.17	10.66	12.21	14.77

Source: ICE, "Memory 1997"

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Figure 2-2. DRAM Market Forecast



Source: ICE, "Memory 1997"

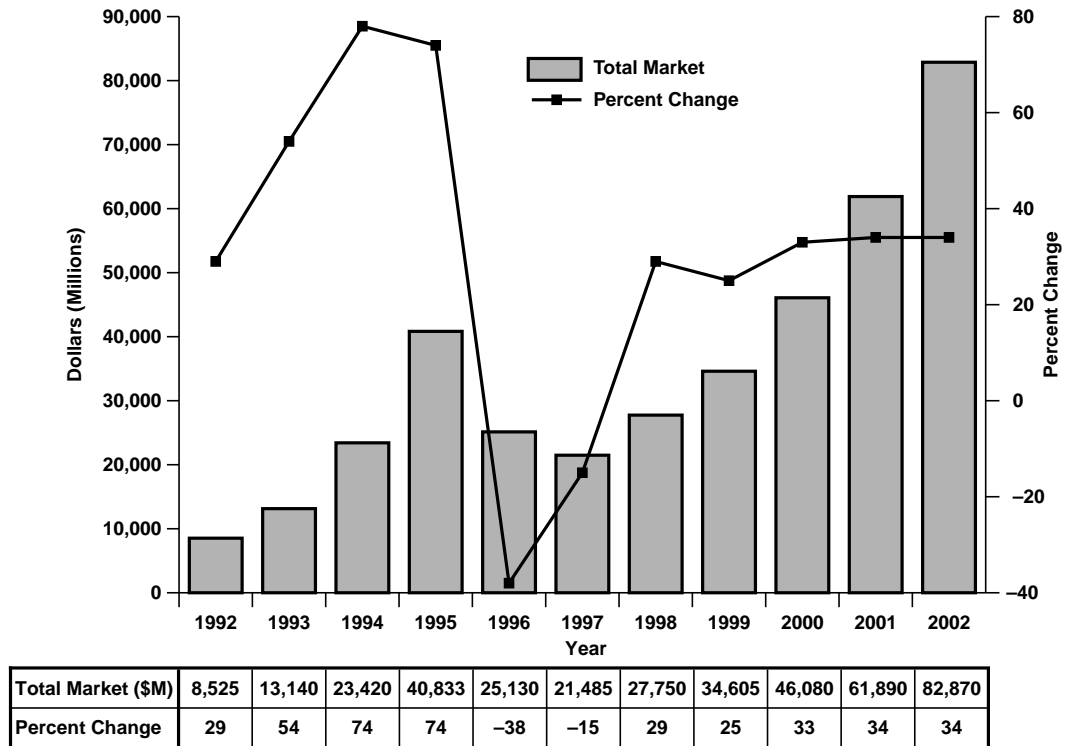
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Figure 2-3. Quarterly DRAM Market

It appears the overall DRAM market stabilized in the latter half of 1996 and into 1Q97. While the market did stabilize, ICE forecasts further erosion of the market in 1997, but at a much more gradual pace.

The total DRAM market for the period 1992-2002 is shown in Figure 2-4. Following four years of outstanding growth, the long-anticipated "recovery" in the market hit in 1996. ICE forecasts that it will take the DRAM market a few more years (to the year 2000) to be at least the size it was in 1995. From 1997 to the year 2002, ICE forecasts the DRAM market to have a cumulative average annual growth rate of 31 percent.

Excess capacity will remain a fact of life for the DRAM suppliers in 1997. The potential for price wars will continue as companies seek to grow or maintain their share of the market. As the decade closes, however, ICE believes DRAM supply and demand will be better balanced. Early into the 2000's, ICE forecasts that demand will once again outstrip supply, causing the market to grow at an accelerated pace.



Source: ICE, "Memory 1997"

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Figure 2-4. DRAM Market Growth

Displayed in Figure 2-5 is the DRAM market by density. In terms of dollar volume, the 16Mbit density was the largest in 1996 and is forecast to remain the biggest market in 1997 and 1998. However, ICE believes that market demand for the 64Mbit generation will develop in 1997 and grow rapidly to challenge the 16Mbit market beginning in 1998. Meanwhile, the 4Mbit density is forecast to quietly slip closer to the obsolete phase in the product lifecycle—a distant “memory” of a grand time in the DRAM market.

DRAM UNIT SHIPMENTS

Shown in Figure 2-6 are quarterly DRAM shipments beginning in 1994 and continuing through 1Q97. During the 13-quarter span, total DRAM shipments increased 89 percent. 4Mbit devices, which accounted for 61 percent of total shipments in 1Q94, represented 36 percent of shipments in 1Q97. Meanwhile, shipments of DRAMs with densities greater than 4Mbit grew rapidly in the last three quarters shown. In 1Q97, these devices accounted for 57 percent of total DRAM unit shipments.

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