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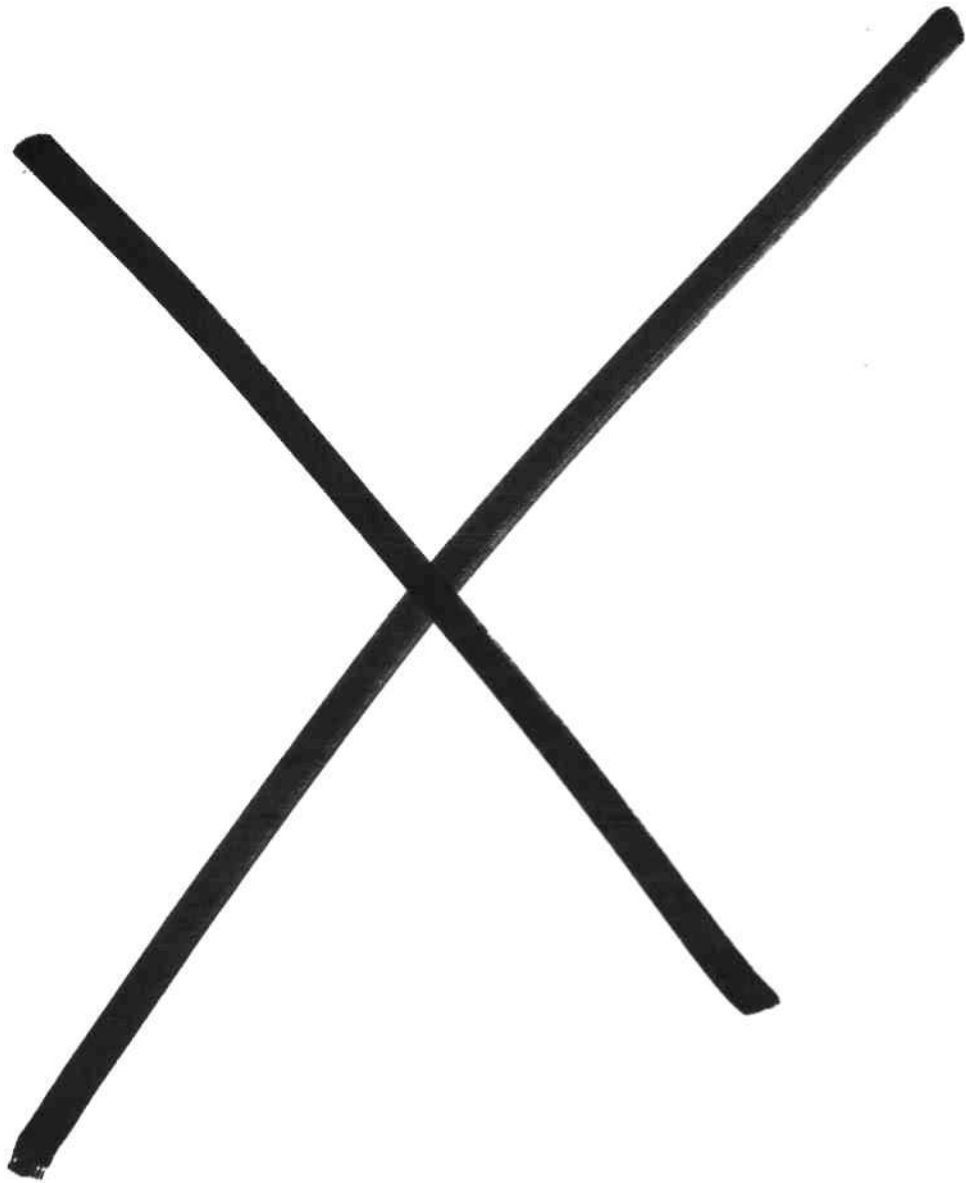
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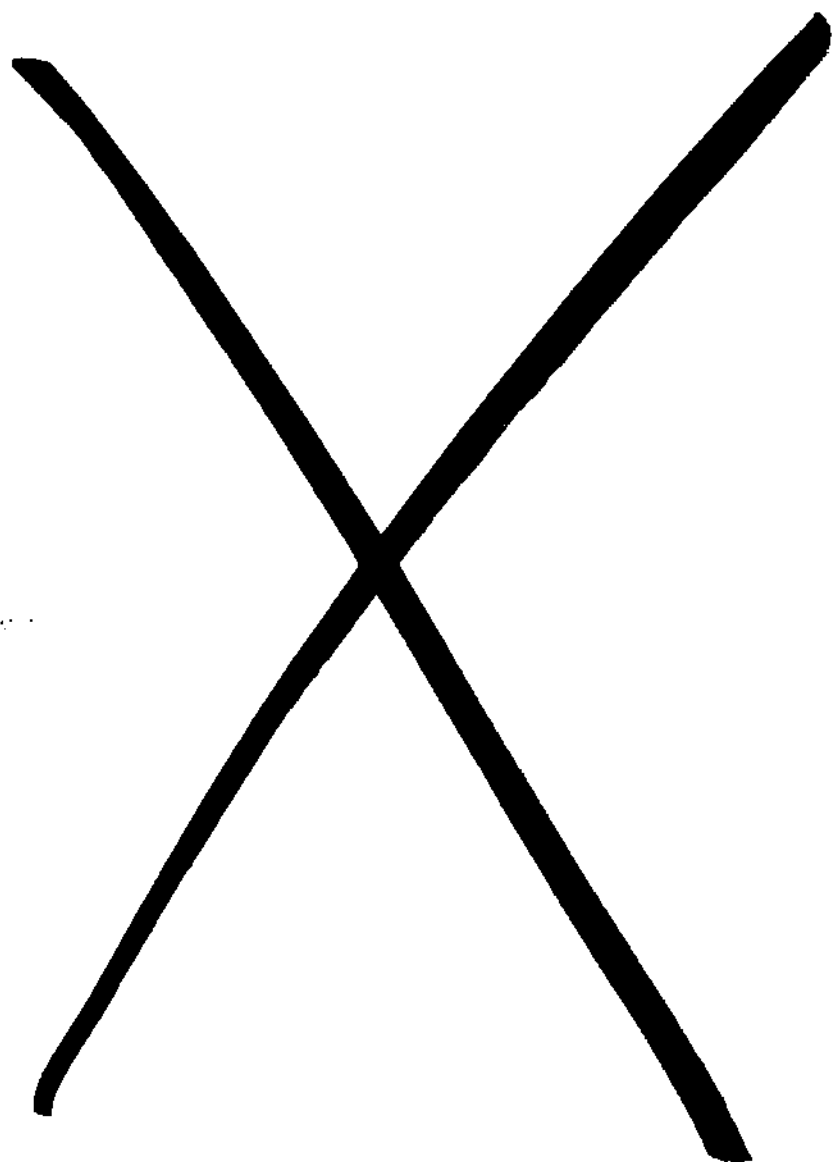
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MOS EPROM—Forecast

THE MARKET—1989

Although MOS EPROM unit growth was 10.0 percent to 394.8 million in 1989, dynamic pricing battles among the giant companies for market share caused revenue to plummet 6.0 percent to \$1.781 billion from \$1.903 billion in 1988. Although Intel maintained its lead with 16.3 percent unit share of the worldwide market, Texas Instruments and SGS-Thomson, each with a more than 12.0 percent share, closed the typically wide gap between number one and the next-highest rankings. AMD, Fujitsu, and National Semiconductor Corporation followed in a very strong race with respective shares of 11.0, 8.9, and 8.4 percent of the market.

COMPARISON WITH EARLIER FORECASTS

The current Dataquest EPROM forecast contains several significant differences from the August 1989 forecast. The changes and reasons for these changes are as follows:

- Actual revenue, unit shipments, and average selling prices (ASPs) for 1989 have been adjusted to reflect final numbers that were completed by the first quarter of 1990.
- The CMOS share of EPROMs continued to grow, representing 65 percent of all EPROM units shipped in 1989, up from 46 percent in 1988.
- US manufacturers led the worldwide EPROM market in producer share with 56.5 percent. While European manufacturers' share grew to 16.6 percent, Japanese manufacturers' share dropped to 26.7 percent from 33.0 percent in 1988.

MARKET OUTLOOK

Dominated by product shortages and higher ASPs in 1988, the EPROM market became a buyer's paradise in 1989 as lead times shortened and overall prices declined 15 percent. Overall EPROM prices averaged \$4.52 in 1989, down from \$5.31 in 1988. A fourth quarter 1988 increase in capacity by US and European EPROM manufacturers turned into a full-scale ramp up in production during the first quarter of 1989 in densities of 256K and above. Worldwide, AMD took the lead in production of high-density devices, producing over 6.6 million 1Mb EPROM units in 1989.

High-density 512K and above devices, which represented 19 percent of total unit volume in 1988, represented 30 percent of total share in 1989. Dataquest expects all of the major EPROM manufacturers to redirect their focus not only on the higher-density 1Mb and above market but also in the direction of packaging and high speed in the late 1990 through 1993 time frame.

Short-Term/Long-Term Forecast

The EPROM pricing softness that occurred during the first half of 1989 continued into drastic price cuts in the second half of 1989, which were very reminiscent of the pricing wars of 1985. Buyers saw 256K EPROM prices drop into the low \$2 range in the fourth quarter of 1989 and the sub-\$2 range in the first quarter of 1990 as US and European suppliers engaged in cutthroat competition for market share at the expense of revenue.

The price declines of late 1989 and early 1990 affected the 64K through 1Mb densities; aggressive pricing for the above-200ns 1Mb device resulted in a first quarter 1989 price of \$16, dropping to sub-\$10 by December 1989. Although the 1Mb density segment grew significantly in 1989 to 34.3 million units, up from 10.6 million, and demand is expected to promote growth through 1991, rumblings of European Community (EC) antidumping rules against South Korean and/or US EPROM producers could alter both price and availability of 1Mb EPROMs in 1991. Strong user demand for the 2Mb and above densities is expected to promote fairly strong bit growth of total EPROMs through the 1993 time frame.

The EPROM supplier and product arena is expected to undergo major changes during the next five years as users perform system redesign and upgrade. Major suppliers from both the United States and Japan are expected to drop out of the 128K and below market and redirect their capital, becoming strictly high-density, high-speed, broad-based nonvolatile suppliers. Users of 200ns and above speeds are redesigning systems for higher performance sub-150ns requirements with alternate-package-styled nonvolatile products. Users of 256K EPROMs now are evaluating the benefits of switching to either high-speed EPROMs, plastic-packaged OTPs, or 1Mb Flash at either 5V or 12V.

Dataquest's MOS EPROM forecast consists of revenue, unit shipments, and prices for MOS EPROM product lines. Table 1 lists the top-level market data for all of the tables. The data include all EPROM revenue, regardless of the technology employed (NMOS or CMOS) or package type (plastic or ceramic). The tables included in these data are as follows:

- Table 1—MOS EPROMs—Total Worldwide Market
- Table 2—Worldwide NMOS EPROM Market—Total (UV and OTP)
- Table 3—Worldwide CMOS EPROM Market—Total (UV and OTP)
- Table 4—Worldwide MOS UV EPROM Market
- Table 5—Worldwide MOS OTP EPROM Market

Table 1

MOS EPROMs—Total Worldwide Market

	Millions of Dollars							
	1987	1988	1989	1990	1991	1992	1993	1994
4K	0	0	0	0	0	0	0	0
8K	0	0	0	0	0	0	0	0
16K	27	36	23	19	18	20	20	19
32K	46	58	40	28	25	24	25	22
64K	227	259	171	124	129	130	133	117
128K	201	259	159	87	82	80	79	67
256K	548	662	514	402	396	369	362	333
512K	254	423	431	326	259	206	179	156
1Mb	46	206	415	550	651	571	464	361
2Mb	0	2	25	96	221	424	517	458
4Mb	0	0	4	57	297	612	766	792
8Mb	0	0	0	0	0	5	22	122
16Mb	0	0	0	0	0	0	4	34
Total	1,350	1,905	1,783	1,690	2,079	2,440	2,571	2,480
% Change from Previous Year	48	41	(6)	(5)	23	17	5	(4)

	Millions of Units							
	1987	1988	1989	1990	1991	1992	1993	1994
4K	0	0	0	0	0	0	0	0
8K	0	0	0	0	0	0	0	0
16K	9.7	9.0	8.4	7.9	7.1	6.5	6.0	5.6
32K	16.2	16.1	13.7	11.7	9.7	8.0	7.0	6.0
64K	75.7	66.7	55.2	50.0	47.0	42.0	37.0	32.0
128K	57.6	63.2	49.1	34.0	28.8	25.0	21.5	18.0
256K	118.4	136.3	151.3	149.0	132.0	110.0	94.0	86.0
512K	30.9	57.1	82.0	80.5	70.0	55.0	46.0	39.0
1Mb	1.7	10.6	34.3	64.0	88.0	87.8	80.0	65.0
2Mb	0	0	0.7	5.8	20.0	53.0	79.5	79.0
4Mb	0	0	0.1	2.1	22.0	68.0	111.0	132.0
8Mb	0	0	0	0	0	0.1	0.7	5.3
16Mb	0	0	0	0	0	0	0.1	0.9
Total	310.1	358.9	394.8	405.0	424.6	455.4	482.8	468.8
% Change from Previous Year	15	16	10	3	5	7	6	(3)

(Continued)

Table 1 (Continued)

MOS EPROMs—Total Worldwide Market

	Average Selling Price							
	1987	1988	1989	1990	1991	1992	1993	1994
4K	0	0	0	0	0	0	0	0
8K	0	0	0	0	0	0	0	0
16K	\$2.80	\$3.97	\$2.79	\$2.40	\$2.55	\$3.00	\$3.40	\$3.40
32K	\$2.83	\$3.60	\$2.95	\$2.42	\$2.60	\$3.05	\$3.50	\$3.60
64K	\$3.00	\$3.89	\$3.10	\$2.48	\$2.75	\$3.10	\$3.60	\$3.65
128K	\$3.50	\$4.10	\$3.23	\$2.55	\$2.85	\$3.20	\$3.68	\$3.71
256K	\$4.63	\$4.86	\$3.40	\$2.70	\$3.00	\$3.35	\$3.85	\$3.87
512K	\$8.24	\$7.41	\$5.25	\$4.05	\$3.70	\$3.75	\$3.90	\$4.00
1Mb	\$27.54	\$19.44	\$12.09	\$8.60	\$7.40	\$6.50	\$5.80	\$5.55
2Mb	0	\$48.00	\$33.82	\$16.57	\$11.05	\$8.00	\$6.50	\$5.80
4Mb	0	0	\$55.42	\$27.00	\$13.50	\$9.00	\$6.90	\$6.00
8Mb	0	0	0	0	\$90.00	\$45.00	\$31.00	\$23.00
16Mb	0	0	0	0	0	\$110.00	\$55.00	\$38.00
Overall ASP	\$4.35	\$5.31	\$4.52	\$4.17	\$4.90	\$5.36	\$5.32	\$5.29
% Change from Previous Year	28	22	(15)	(8)	17	9	(1)	(1)

Source: Dataquest (August 1990)

Table 2

Worldwide NMOS EPROM Market—Total (UV and OTP)

	Millions of Dollars							
	1987	1988	1989	1990	1991	1992	1993	1994
4K	0	0	0	0	0	0	0	0
8K	0	0	0	0	0	0	0	0
16K	19	17	11	6	5	5	3	2
32K	36	42	29	20	16	14	13	11
64K	143	145	82	41	32	25	19	15
128K	157	179	85	30	19	10	6	2
256K	312	260	143	65	45	37	31	23
512K	179	231	153	98	57	38	23	12
1Mb	8	28	0	0	0	0	0	0
2Mb	0	0	0	0	0	0	0	0
4Mb	0	0	0	0	0	0	0	0
8Mb	0	0	0	0	0	0	0	0
16Mb	0	0	0	0	0	0	0	0
Total	854	902	502	260	174	128	95	64
% Change from Previous Year	15	6	(44)	(48)	(33)	(27)	(25)	(33)

	Millions of Units							
	1987	1988	1989	1990	1991	1992	1993	1994
4K	0	0	0	0	0	0	0	0
8K	0	0	0	0	0	0	0	0
16K	7.3	5.3	4.5	2.9	2.1	1.5	1.0	0.5
32K	13.1	11.9	9.8	8.0	6.2	4.7	3.8	3.0
64K	48.5	38.2	26.5	16.0	11.5	8.0	5.2	4.0
128K	46.3	45.4	26.4	11.5	6.8	3.0	1.5	0.5
256K	71.6	57.6	42.3	24.0	15.0	11.0	8.0	6.0
512K	22.2	32.4	30.2	25.5	15.4	10.0	6.0	3.0
1Mb	0.3	1.3	0	0	0	0	0	0
2Mb	0	0	0	0	0	0	0	0
4Mb	0	0	0	0	0	0	0	0
8Mb	0	0	0	0	0	0	0	0
16Mb	0	0	0	0	0	0	0	0
Total	209.3	192.1	139.7	87.9	57.0	38.2	25.5	17.0
% Change from Previous Year	(9)	(8)	(27)	(37)	(35)	(33)	(33)	(33)

(Continued)

Table 2 (Continued)

Worldwide NMOS EPROM Market—Total (UV and OTP)

	Average Selling Price							
	1987	1988	1989	1990	1991	1992	1993	1994
4K	0	0	0	0	0	0	0	0
8K	0	0	0	0	0	0	0	0
16K	\$2.62	\$3.20	\$2.40	\$2.20	\$2.40	\$3.00	\$3.40	\$3.40
32K	\$2.77	\$3.53	\$2.96	\$2.45	\$2.60	\$3.05	\$3.50	\$3.60
64K	\$2.95	\$3.79	\$3.09	\$2.55	\$2.75	\$3.10	\$3.60	\$3.65
128K	\$3.38	\$3.95	\$3.23	\$2.65	\$2.85	\$3.20	\$3.68	\$3.71
256K	\$4.36	\$4.52	\$3.37	\$2.70	\$3.00	\$3.35	\$3.85	\$3.87
512K	\$8.06	\$7.12	\$5.05	\$3.85	\$3.70	\$3.75	\$3.90	\$4.00
1Mb	\$24.32	\$22.06	0	0	0	0	0	0
2Mb	0	0	0	0	0	0	0	0
4Mb	0	0	0	0	0	0	0	0
8Mb	0	0	0	0	0	0	0	0
16Mb	0	0	0	0	0	0	0	0
Overall ASP	\$4.08	\$4.70	\$3.59	\$2.96	\$3.06	\$3.34	\$3.73	\$3.78
% Change from Previous Year	27	15	(23)	(18)	3	9	12	1

Source: Dataquest (August 1990)

Table 3

Worldwide CMOS EPROM Market—Total (UV and OTP)

	Millions of Dollars							
	1987	1988	1989	1990	1991	1992	1993	1994
4K	0	0	0	0	0	0	0	0
8K	0	0	0	0	0	0	0	0
16K	8	19	13	12	13	15	17	17
32K	10	16	11	9	9	10	11	11
64K	84	114	89	83	98	105	114	102
128K	45	80	73	56	63	70	74	65
256K	236	402	372	338	351	332	331	310
512K	75	192	278	230	202	169	156	144
1Mb	38	178	415	550	651	571	464	361
2Mb	0	2	25	96	221	424	517	458
4Mb	0	0	4	57	297	612	766	792
8Mb	0	0	0	0	0	5	22	122
16Mb	0	0	0	0	0	0	4	34
Total	496	1,002	1,280	1,431	1,904	2,312	2,476	2,416
% Change from Previous Year	187	102	28	12	33	21	7	(2)

	Millions of Units							
	1987	1988	1989	1990	1991	1992	1993	1994
4K	0	0	0	0	0	0	0	0
8K	0	0	0	0	0	0	0	0
16K	2.4	3.7	4.0	5.0	5.0	5.0	5.0	5.1
32K	3.1	4.1	3.8	3.7	3.5	3.3	3.2	3.0
64K	27.2	28.4	28.7	34.0	35.5	34.0	31.8	28.0
128K	11.2	17.8	22.7	22.5	22.0	22.0	20.0	17.5
256K	46.9	78.7	109.0	125.0	117.0	99.0	86.0	80.0
512K	8.7	24.7	51.8	55.4	54.6	45.0	40.0	36.0
1Mb	1.4	9.3	34.3	64.0	88.0	87.8	80.0	65.0
2Mb	0	0	0.7	5.8	20.0	53.0	79.5	79.0
4Mb	0	0	0.1	2.1	22.0	68.0	111.0	132.0
8Mb	0	0	0	0	0	0.1	0.7	5.3
16Mb	0	0	0	0	0	0	0.1	0.9
Total	100.8	166.8	255.1	317.5	367.6	417.2	457.3	451.8
% Change from Previous Year	163	65	53	24	16	13	10	(1)

(Continued)

Table 3 (Continued)

Worldwide CMOS EPROM Market—Total (UV and OTP)

	Average Selling Price							
	1987	1988	1989	1990	1991	1992	1993	1994
4K	0	0	0	0	0	0	0	0
8K	0	0	0	0	0	0	0	0
16K	\$3.36	\$5.05	\$3.22	\$2.45	\$2.55	\$3.00	\$3.40	\$3.40
32K	\$3.08	\$3.83	\$2.93	\$2.40	\$2.60	\$3.05	\$3.50	\$3.60
64K	\$3.08	\$4.01	\$3.11	\$2.45	\$2.75	\$3.10	\$3.60	\$3.65
128K	\$4.00	\$4.47	\$3.22	\$2.50	\$2.85	\$3.20	\$3.68	\$3.71
256K	\$5.04	\$5.11	\$3.41	\$2.70	\$3.00	\$3.35	\$3.85	\$3.87
512K	\$8.69	\$7.79	\$5.36	\$4.15	\$3.70	\$3.75	\$3.90	\$4.00
1Mb	\$28.27	\$19.08	\$12.09	\$8.60	\$7.40	\$6.50	\$5.80	\$5.55
2Mb	0	\$48.00	\$33.82	\$16.57	\$11.05	\$8.00	\$6.50	\$5.80
4Mb	0	0	\$55.42	\$27.00	\$13.50	\$9.00	\$6.90	\$6.00
8Mb	0	0	0	0	\$90.00	\$45.00	\$31.00	\$23.00
16Mb	0	0	0	0	0	\$110.00	\$55.00	\$38.00
Total	\$4.92	\$6.01	\$5.02	\$4.51	\$5.18	\$5.54	\$5.41	\$5.35
% Change from Previous Year	9	22	(16)	(10)	15	7	(2)	(1)

Source: Dataquest (August 1990)

Table 4

Worldwide MOS UV EPROM Market

	Millions of Dollars							
	1987	1988	1989	1990	1991	1992	1993	1994
4K	0	0	0	0	0	0	0	0
8K	0	0	0	0	0	0	0	0
16K	27	36	23	19	18	20	20	19
32K	46	58	40	28	25	24	25	22
64K	174	227	147	89	84	77	76	66
128K	182	235	145	75	67	59	53	41
256K	479	594	445	322	323	266	244	215
512K	242	402	408	314	243	189	156	127
1Mb	46	200	386	501	576	478	362	263
2Mb	0	2	25	94	213	396	455	390
4Mb	0	0	4	57	294	601	727	729
8Mb	0	0	0	0	0	5	22	122
16Mb	0	0	0	0	0	0	6	34
Total	1,197	1,754	1,624	1,499	1,843	2,114	2,146	2,027
% Change from Previous Year	42	47	(7)	(8)	23	15	2	(6)

	Millions of Units							
	1987	1988	1989	1990	1991	1992	1993	1994
4K	0	0	0	0	0	0	0	0
8K	0	0	0	0	0	0	0	0
16K	9.7	9.0	8.4	7.9	7.1	6.5	6.0	5.6
32K	16.2	16.1	13.7	11.7	9.7	8.0	7.0	6.0
64K	56.3	60.2	46.0	34.9	30.4	24.8	21.1	18.0
128K	50.3	56.9	43.9	28.6	23.1	18.3	14.5	11.0
256K	100.8	119.3	127.5	118.7	100.9	79.3	63.5	55.6
512K	29.0	51.1	75.7	74.8	64.0	49.1	40.0	31.8
1Mb	1.7	10.3	31.9	57.6	76.5	72.8	62.4	47.4
2Mb	0	0	0.7	5.7	19.0	48.8	70.0	67.2
4Mb	0	0	0.1	2.1	21.8	66.0	105.4	121.5
8Mb	0	0	0	0	0	0.1	0.7	5.3
16Mb	0	0	0	0	0	0	0.1	0.9
Total	264.1	322.9	347.9	342.0	352.5	373.7	390.7	370.3
% Change from Previous Year	8	22	8	(2)	3	6	5	(5)

(Continued)

Table 4 (Continued)

Worldwide MOS UV EPROM Market

	Average Selling Price							
	1987	1988	1989	1990	1991	1992	1993	1994
4K	0	0	0	0	0	0	0	0
8K	0	0	0	0	0	0	0	0
16K	\$2.80	\$3.96	\$2.79	\$2.43	\$2.55	\$3.00	\$3.40	\$3.40
32K	\$2.83	\$3.61	\$2.95	\$2.43	\$2.60	\$3.05	\$3.50	\$3.60
64K	\$3.08	\$3.77	\$3.20	\$2.54	\$2.77	\$3.10	\$3.60	\$3.65
128K	\$3.62	\$4.13	\$3.29	\$2.61	\$2.88	\$3.20	\$3.68	\$3.71
256K	\$4.75	\$4.98	\$3.49	\$2.71	\$3.20	\$3.35	\$3.85	\$3.87
512K	\$8.35	\$7.87	\$5.39	\$4.20	\$3.80	\$3.85	\$3.90	\$4.00
1Mb	\$27.53	\$19.47	\$12.09	\$8.70	\$7.53	\$6.57	\$5.80	\$5.55
2Mb	0	0	\$33.82	\$16.57	\$11.20	\$8.12	\$6.50	\$5.80
4Mb	0	0	\$55.42	\$27.00	\$13.50	\$9.11	\$6.90	\$6.00
8Mb	0	0	0	0	\$90.00	\$45.00	\$31.00	\$23.00
16Mb	0	0	0	0	0	\$110.00	\$55.00	\$38.00
Total	\$4.53	\$5.43	\$4.67	\$4.38	\$5.23	\$5.66	\$5.49	\$5.48

Source: Dataquest (August 1990)

Table 5

Worldwide MOS OTP EPROM Market Value

	Millions of Dollars							
	1987	1988	1989	1990	1991	1992	1993	1994
4K	0	0	0	0	0	0	0	0
8K	0	0	0	0	0	0	0	0
16K	0	0	0	0	0	0	0	0
32K	0	0	0	0	0	0	0	0
64K	51	21	25	34	39	45	49	44
128K	21	22	14	13	14	18	22	23
256K	65	66	68	74	79	87	100	104
512K	14	37	27	21	19	19	20	25
1Mb	0	5	24	48	73	84	87	86
2Mb	0	0	0	1	9	29	53	61
4Mb	0	0	0	0	2	15	33	56
Total	151	151	159	191	236	298	364	398
% Change from Previous Year	111	0	5	20	24	26	22	9

	Millions of Units							
	1987	1988	1989	1990	1991	1992	1993	1994
4K	0	0	0	0	0	0	0	0
8K	0	0	0	0	0	0	0	0
16K	0	0	0	0	0	0	0	0
32K	0	0	0	0	0	0	0	0
64K	19.3	6.5	9.2	15.1	16.6	17.2	15.9	14.0
128K	7.2	6.2	5.2	5.4	5.7	6.7	7.0	7.0
256K	17.6	17.0	23.8	30.3	31.1	30.7	30.5	30.4
512K	1.8	6.0	6.3	5.7	6.0	5.9	6.0	7.2
1Mb	0	0.3	2.4	6.4	11.5	15.0	17.6	17.6
2Mb	0	0	0	0.1	1.0	4.2	9.5	11.8
4Mb	0	0	0	0	0.2	2.0	5.6	10.5
Total	46.0	36.0	46.9	63.0	72.1	81.7	92.1	98.5

(Continued)

Table 5 (Continued)

Worldwide MOS OTP EPROM Market Value

	Average Selling Price							
	1987	1988	1989	1990	1991	1992	1993	1994
4K	0	0	0	0	0	0	0	0
8K	0	0	0	0	0	0	0	0
16K	0	0	0	0	0	0	0	0
32K	0	0	0	0	0	0	0	0
64K	2.64	3.29	2.66	2.25	2.34	2.60	0	0
128K	2.92	3.54	2.78	2.33	2.51	2.72	0	0
256K	3.67	3.86	2.87	2.45	2.55	2.85	3.27	3.41
512K	7.56	6.16	4.27	3.72	3.18	3.26	3.39	3.52
1Mb	0	16.05	10.20	7.45	6.36	5.58	4.94	4.89
2Mb	0	0	0	14.11	9.46	6.90	5.57	5.15
4Mb	0	0	0	0	11.48	7.74	5.90	5.30
Overall ASP	3.27	4.19	3.38	3.03	3.28	3.65	3.95	4.04

Source: Dataquest (August 1990)

MOS EPROM--Forecast

Dataquest's MOS EPROM data consist of revenue, unit shipments, and prices for MOS EPROM product lines. Table 1 lists the top-level market data for all of the tables. The data include all EPROM revenue, regardless of the technology employed (NMOS or CMOS) or package type (plastic or ceramic). The tables included in these data are as follows:

- Table 1—MOS EPROMs—Total Worldwide Market
- Table 2—Worldwide NMOS EPROM Market—Total (UV and OTP)
- Table 3—Worldwide CMOS EPROM Market—Total (UV and OTP)
- Table 4—Worldwide MOS UV EPROM Market—Total (NMOS and CMOS)
- Table 5—Worldwide NMOS UV EPROM Market
- Table 6—Worldwide CMOS UV EPROM Market
- Table 7—Worldwide MOS OTP EPROM Market—Total (NMOS and CMOS)
- Table 8—Worldwide NMOS OTP EPROM Market
- Table 9—Worldwide CMOS OTP EPROM Market

MOS EPROM--Forecast

Table 1

MOS EPROMs--Total Worldwide Market

	Millions of Dollars							
	1986	1987	1988	1989	1990	1991	1992	1993
4K	0	0	0	0	0	0	0	0
8K	0	0	0	0	0	0	0	0
16K	\$ 35	\$ 27	\$ 33	\$ 31	\$ 28	\$ 28	\$ 26	\$ 26
32K	48	46	50	45	40	36	34	31
64K	266	227	254	247	220	216	172	122
128K	163	201	254	239	194	121	103	89
256K	320	548	634	592	512	439	418	393
512K	68	254	449	496	395	317	255	216
1Mb	12	46	176	521	741	757	651	554
2Mb	0	0	0	11	25	119	445	648
4Mb	0	0	18	77	182	536	802	1,096
8Mb	0	0	0	0	0	0	5	136
Total	\$913	\$1,350	\$1,868	\$2,258	\$2,338	\$2,569	\$2,911	\$3,312
% Change from Previous Year	4%	48%	38%	21%	4%	10%	13%	14%

	Millions of Units							
	1986	1987	1988	1989	1990	1991	1992	1993
4K	0	0	0	0	0	0	0	0
8K	0	0	0	0	0	0	0	0
16K	14.7	9.7	8.6	7.8	7.0	6.8	6.4	6.2
32K	21.6	16.2	13.9	11.6	10.0	8.8	8.0	7.3
64K	99.6	75.7	65.3	61.0	54.0	52.0	40.0	28.0
128K	57.3	57.6	61.9	58.0	47.0	28.8	23.6	20.1
256K	70.0	118.4	130.8	130.0	122.0	102.0	95.0	86.0
512K	5.7	30.9	60.9	78.0	77.5	69.0	54.0	45.0
1Mb	0.2	1.7	9.0	37.2	68.0	88.0	87.8	85.0
2Mb	0	0	0	0.3	1.4	10.0	50.0	82.0
4Mb	0	0	0.2	1.7	7.0	36.0	81.0	126.0
8Mb	0	0	0	0	0	0	0.1	4.0
Total	269.1	310.1	350.7	385.6	393.9	401.4	445.9	489.6
% Change from Previous Year	10%	15%	13%	10%	2%	2%	11%	10%

(Continued)

MOS EPROM--Forecast

Table 1 (Continued)

MOS EPROMs--Total Worldwide Market

	Average Selling Price (\$)							
	1986	1987	1988	1989	1990	1991	1992	1993
4K	0	0	0	0	0	0	0	0
8K	0	0	0	0	0	0	0	0
16K	\$ 2.40	\$ 2.80	\$ 3.88	\$ 4.00	\$ 4.00	\$ 4.07	\$ 4.10	\$ 4.20
32K	\$ 2.24	\$ 2.83	\$ 3.57	\$ 3.88	\$ 4.04	\$ 4.10	\$ 4.20	\$ 4.25
64K	\$ 2.67	\$ 3.00	\$ 3.89	\$ 4.05	\$ 4.08	\$ 4.15	\$ 4.30	\$ 4.35
128K	\$ 2.85	\$ 3.50	\$ 4.10	\$ 4.12	\$ 4.12	\$ 4.20	\$ 4.35	\$ 4.45
256K	\$ 4.57	\$ 4.63	\$ 4.85	\$ 4.55	\$ 4.20	\$ 4.30	\$ 4.40	\$ 4.57
512K	\$11.96	\$ 8.23	\$ 7.36	\$ 6.36	\$ 5.10	\$ 4.60	\$ 4.72	\$ 4.80
1Mb	\$56.87	\$27.54	\$19.51	\$14.00	\$10.90	\$ 8.60	\$ 7.42	\$ 6.52
2Mb	0	0	0	\$35.00	\$18.00	\$11.90	\$ 8.90	\$ 7.90
4Mb	0	0	\$80.00	\$45.00	\$26.00	\$14.90	\$ 9.90	\$ 8.70
8Mb	0	0	0	0	0	\$90.00	\$50.00	\$34.00
Overall ASP	\$ 3.39	\$ 4.35	\$ 5.33	\$ 5.85	\$ 5.94	\$ 6.40	\$ 6.53	\$ 6.76
% Change from Previous Year	(5%)	28%	22%	10%	1%	8%	2%	4%

Source: Dataquest
August 1989

MOS EPROM--Forecast

Table 2

Worldwide NMOS EPROM Market--Total (UV and OTP)

	Millions of Dollars							
	1986	1987	1988	1989	1990	1991	1992	1993
4K	0	0	0	0	0	0	0	0
8K	0	0	0	0	0	0	0	0
16K	\$ 35	\$ 19	\$ 18	\$ 12	\$ 11	\$ 9	\$ 8	\$ 7
32K	44	36	42	34	26	23	21	18
64K	206	143	145	90	57	45	36	23
128K	152	157	174	144	107	58	43	33
256K	237	312	262	163	116	80	81	52
512K	63	179	279	236	138	87	50	29
1Mb	3	8	28	94	56	25	15	11
2Mb	0	0	0	0	0	0	0	0
4Mb	0	0	0	0	0	0	0	0
8Mb	0	0	0	0	0	0	0	0
Total	\$740	\$854	\$949	\$773	\$510	\$327	\$253	\$173
% Change from Previous Year	(6%)	15%	11%	(18%)	(34%)	(36%)	(23%)	(31%)

	Millions of Units							
	1986	1987	1988	1989	1990	1991	1992	1993
4K	0	0	0	0	0	0	0	0
8K	0	0	0	0	0	0	0	0
16K	14.7	7.3	5.6	3.5	2.9	2.4	1.9	1.7
32K	18.9	13.1	11.9	9.3	7.0	5.8	5.0	4.3
64K	82.5	48.5	38.3	24.0	15.0	11.5	8.5	5.4
128K	55.4	46.3	44.1	36.1	26.8	14.1	10.1	7.6
256K	53.8	71.6	58.0	38.0	28.0	19.0	18.8	11.5
512K	5.4	22.2	39.2	37.5	27.5	19.4	11.0	6.0
1Mb	0.1	0.3	1.3	5.2	5.0	2.8	2.0	1.7
2Mb	0	0	0	0	0	0	0	0
4Mb	0	0	0	0	0	0	0	0
8Mb	0	0	0	0	0	0	0	0
Total	230.9	209.3	198.3	153.6	112.2	75.0	57.3	38.2
% Change From Previous Year	3%	(9%)	(5%)	(23%)	(27%)	(33%)	(24%)	(33%)

(Continued)

MOS EPROM--Forecast

Table 2 (Continued)

Worldwide NMOS EPROM Market—Total (UV and OTP)

	Average Selling Price (\$)							
	1986	1987	1988	1989	1990	1991	1992	1993
4K	0	0	0	0	0	0	0	0
8K	0	0	0	0	0	0	0	0
16K	\$ 2.40	\$ 2.62	\$ 3.22	\$ 3.55	\$ 3.60	\$3.80	\$4.05	\$4.20
32K	\$ 2.32	\$ 2.77	\$ 3.53	\$ 3.65	\$ 3.75	\$3.90	\$4.15	\$4.25
64K	\$ 2.49	\$ 2.95	\$ 3.80	\$ 3.75	\$ 3.80	\$3.95	\$4.20	\$4.30
128K	\$ 2.75	\$ 3.38	\$ 3.95	\$ 4.00	\$ 4.00	\$4.10	\$4.25	\$4.40
256K	\$ 4.40	\$ 4.36	\$ 4.52	\$ 4.30	\$ 4.14	\$4.20	\$4.30	\$4.48
512K	\$11.73	\$ 8.06	\$ 7.12	\$ 6.28	\$ 5.00	\$4.50	\$4.54	\$4.75
1Mb	\$48.50	\$24.32	\$22.06	\$18.00	\$11.20	\$8.80	\$7.40	\$6.55
2Mb	0	0	0	0	0	0	0	0
4Mb	0	0	0	0	0	0	0	0
8Mb	0	0	0	0	0	0	0	0
Overall ASP	\$ 3.21	\$ 4.08	\$ 4.78	\$ 5.03	\$ 4.55	\$4.36	\$4.41	\$4.53
% Change from Previous Year	(7%)	27%	17%	5%	(10%)	(4%)	1%	3%

Source: Dataquest
August 1989

MOS EPROM--Forecast

Table 3

Worldwide CMOS EPROM Market--Total (UV and OTP)

	<u>Millions of Dollars</u>							
	<u>1986</u>	<u>1987</u>	<u>1988</u>	<u>1989</u>	<u>1990</u>	<u>1991</u>	<u>1992</u>	<u>1993</u>
4K	0	0	0	0	0	0	0	0
8K	0	0	0	0	0	0	0	0
16K	0	\$ 8	\$ 16	\$ 19	\$ 17	\$ 18	\$ 19	\$ 19
32K	\$ 7	10	8	9	13	13	13	13
64K	65	84	109	152	168	172	135	98
128K	7	45	80	96	84	62	59	56
256K	80	236	372	415	400	359	337	340
512K	4	75	170	258	265	231	204	189
1Mb	9	38	148	448	674	733	639	543
2Mb	0	0	0	11	25	119	445	648
4Mb	0	0	18	77	182	536	802	1,096
8Mb	0	0	0	0	0	0	5	136
Total	\$173	\$496	\$920	\$1,485	\$1,827	\$2,243	\$2,658	\$3,138
% Change from Previous Year	60%	187%	85%	61%	23%	23%	19%	18%

	<u>Millions of Units</u>							
	<u>1986</u>	<u>1987</u>	<u>1988</u>	<u>1989</u>	<u>1990</u>	<u>1991</u>	<u>1992</u>	<u>1993</u>
4K	0	0	0	0	0	0	0	0
8K	0	0	0	0	0	0	0	0
16K	0	2.4	3.1	4.3	4.1	4.4	4.5	4.5
32K	2.7	3.1	2.0	2.3	3.0	3.0	3.0	3.0
64K	17.1	27.2	27.0	37.0	39.0	40.5	31.5	22.6
128K	1.9	11.2	17.8	21.9	20.2	14.7	13.5	12.5
256K	16.2	46.9	72.8	92.0	94.0	83.0	76.2	74.5
512K	0.3	8.7	21.7	40.5	50.0	49.6	43.0	39.0
1Mb	0.1	1.4	7.8	32.0	63.0	85.2	85.8	83.3
2Mb	0	0	0	0.3	1.4	10.0	50.0	82.0
4Mb	0	0	0.2	1.7	7.0	36.0	81.0	126.0
8Mb	0	0	0	0	0	0	0.1	4.0
Total	38.3	100.8	152.4	232.0	281.7	326.4	388.6	451.4
% Change from Previous Year	82%	163%	51%	52%	21%	16%	19%	16%

(Continued)

MOS EPROM--Forecast

Table 3 (Continued)

Worldwide CMOS EPROM Market--Total (UV and OTP)

	Average Selling Price (\$)							
	1986	1987	1988	1989	1990	1991	1992	1993
4K	0	0	0	0	0	0	0	0
8K	0	0	0	0	0	0	0	0
16K	0	\$ 3.36	\$ 5.08	\$ 4.50	\$ 4.20	\$ 4.10	\$ 4.20	\$ 4.20
32K	\$ 2.71	\$ 3.08	\$ 3.81	\$ 3.90	\$ 4.30	\$ 4.20	\$ 4.20	\$ 4.25
64K	\$ 3.80	\$ 3.08	\$ 4.02	\$ 4.10	\$ 4.30	\$ 4.25	\$ 4.30	\$ 4.35
128K	\$ 3.89	\$ 4.00	\$ 4.47	\$ 4.40	\$ 4.15	\$ 4.25	\$ 4.38	\$ 4.45
256K	\$ 4.93	\$ 5.04	\$ 5.11	\$ 4.51	\$ 4.25	\$ 4.32	\$ 4.42	\$ 4.57
512K	\$13.95	\$ 8.69	\$ 7.80	\$ 6.38	\$ 5.30	\$ 4.65	\$ 4.75	\$ 4.85
1Mb	\$62.62	\$28.27	\$19.09	\$14.00	\$10.70	\$ 8.60	\$ 7.45	\$ 6.52
2Mb	0	0	0	\$35.00	\$18.00	\$11.90	\$ 8.90	\$ 7.90
4Mb	0	0	\$80.00	\$45.00	\$26.00	\$14.90	\$ 9.90	\$ 8.70
8Mb	0	0	0	0	0	\$90.00	\$50.00	\$34.00
Overall ASP	\$ 4.52	\$ 4.92	\$ 6.03	\$ 6.40	\$ 6.49	\$ 6.87	\$ 6.84	\$ 6.95
% Change from Previous Year		9%	23%	6%	1%	6%	0	2%

Source: Dataquest
August 1989

MOS EPROM--Forecast

Table 4

Worldwide MOS UV EPROM Market--Total (NMOS and CMOS)

	Millions of Dollars							
	1986	1987	1988	1989	1990	1991	1992	1993
4K	0	0	0	0	0	0	0	0
8K	0	0	0	0	0	0	0	0
16K	\$ 35	\$ 27	\$ 33	\$ 32	\$ 28	\$ 27	\$ 27	\$ 26
32K	46	46	50	43	39	35	33	31
64K	256	174	232	228	213	215	173	125
128K	150	182	234	229	186	119	103	91
256K	272	478	574	536	494	425	412	387
512K	68	246	414	409	333	265	204	181
1Mb	12	46	171	507	632	605	485	458
2Mb	0	0	0	11	24	86	389	546
4Mb	0	0	18	77	163	486	721	896
8Mb	0	0	0	0	0	0	5	136
Total	\$840	\$1,199	\$1,726	\$2,070	\$2,111	\$2,264	\$2,552	\$2,877
% Change from Previous Year	(5%)	43%	44%	20%	2%	7%	13%	13%

	Millions of Units							
	1986	1987	1988	1989	1990	1991	1992	1993
4K	0	0	0	0	0	0	0	0
8K	0	0	0	0	0	0	0	0
16K	14.7	9.7	8.6	7.8	7.0	6.8	6.4	6.2
32K	20.7	16.2	13.9	11.6	10.0	8.8	8.0	7.3
64K	93.9	56.3	58.8	56.1	51.0	50.4	39.5	28.0
128K	52.2	50.3	55.8	53.9	44.6	27.8	23.4	20.1
256K	57.5	100.8	115.3	117.0	112.7	95.1	89.3	81.5
512K	5.7	29.0	55.0	63.0	61.8	55.0	41.9	34.5
1Mb	0.2	1.7	8.7	34.2	57.0	68.0	63.8	61.5
2Mb	0	0	0	0.3	1.3	7.0	42.0	65.0
4Mb	0	0	0.2	1.7	6.2	32.0	70.0	106.0
8Mb	0	0	0	0	0	0	0.1	4.0
Total	244.8	264.1	316.3	345.6	351.6	350.9	384.4	414.1
% Change from Previous Year	0	8%	20%	9%	2%	0	10%	8%

(Continued)

MOS EPROM--Forecast

Table 4 (Continued)

Worldwide MOS UV EPROM Market--Total (NMOS and CMOS)

	Average Selling Price (\$)							
	1986	1987	1988	1989	1990	1991	1992	1993
4K	0	0	0	0	0	0	0	0
8K	0	0	0	0	0	0	0	0
16K	\$ 2.40	\$ 2.80	\$ 3.88	\$ 4.07	\$ 3.95	\$ 3.99	\$ 4.16	\$ 4.20
32K	\$ 2.24	\$ 2.83	\$ 3.57	\$ 3.70	\$ 3.92	\$ 4.00	\$ 4.17	\$ 4.25
64K	\$ 2.73	\$ 3.08	\$ 3.95	\$ 4.06	\$ 4.18	\$ 4.26	\$ 4.37	\$ 4.46
128K	\$ 2.88	\$ 3.62	\$ 4.20	\$ 4.24	\$ 4.17	\$ 4.28	\$ 4.40	\$ 4.53
256K	\$ 4.73	\$ 4.74	\$ 4.98	\$ 4.58	\$ 4.38	\$ 4.47	\$ 4.62	\$ 4.75
512K	\$11.94	\$ 8.49	\$ 7.52	\$ 6.49	\$ 5.39	\$ 4.82	\$ 4.87	\$ 5.25
1Mb	\$58.57	\$27.53	\$19.63	\$14.82	\$11.09	\$ 8.90	\$ 7.60	\$ 7.45
2Mb	0	0	0	\$35.00	\$18.45	\$12.25	\$ 9.26	\$ 8.40
4Mb	0	0	0	\$45.00	\$26.25	\$15.20	\$10.30	\$ 8.45
8Mb	0	0	0	0	0	\$90.00	\$50.00	\$34.00
Overall ASP	\$ 3.43	\$ 4.54	\$ 5.46	\$ 5.99	\$ 6.01	\$ 6.45	\$ 6.64	\$ 6.95
% Change from Previous Year	(5%)	32%	20%	10%	0	7%	3%	5%

Source: Dataquest
August 1989

MOS EPROM--Forecast

Table 5
Worldwide NMOS UV EPROM Market

	<u>Millions of Dollars</u>							
	<u>1986</u>	<u>1987</u>	<u>1988</u>	<u>1989</u>	<u>1990</u>	<u>1991</u>	<u>1992</u>	<u>1993</u>
4K	0	0	0	0	0	0	0	0
8K	0	0	0	0	0	0	0	0
16K	\$ 35	\$ 19	\$ 18	\$ 12	\$ 10	\$ 9	\$ 8	\$ 7
32K	39	36	42	34	26	23	21	18
64K	193	122	135	85	54	44	36	23
128K	143	137	161	139	104	57	43	34
256K	202	252	239	149	106	74	62	48
512K	63	172	249	175	106	66	35	16
1Mb	3	8	28	94	56	25	15	12
2Mb	0	0	0	0	0	0	0	0
4Mb	0	0	0	0	0	0	0	0
8Mb	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total	\$679	\$745	\$872	\$688	\$462	\$297	\$220	\$158
% Change from Previous Year	(13%)	10%	17%	(21%)	(33%)	(36%)	(26%)	(28%)

	<u>Millions of Units</u>							
	<u>1986</u>	<u>1987</u>	<u>1988</u>	<u>1989</u>	<u>1990</u>	<u>1991</u>	<u>1992</u>	<u>1993</u>
4K	0	0	0	0	0	0	0	0
8K	0	0	0	0	0	0	0	0
16K	14.7	7.3	5.6	3.5	2.9	2.4	1.9	1.7
32K	18.1	13.1	11.9	9.3	7.0	5.8	5.0	4.3
64K	77.6	40.6	35.1	22.1	14.0	11.1	8.5	5.4
128K	50.3	39.5	39.7	33.8	25.6	13.7	10.1	7.6
256K	43.4	56.9	51.7	33.9	25.0	16.9	14.0	10.5
512K	5.4	20.4	34.3	27.5	20.5	14.4	7.4	3.0
1Mb	0.1	0.3	1.3	5.2	5.0	2.8	2.0	1.7
2Mb	0	0	0	0	0	0	0	0
4Mb	0	0	0	0	0	0	0	0
8Mb	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total	209.5	178.1	179.5	135.3	100.0	67.1	48.9	34.2
% Change from Previous Year	(7%)	(15%)	1%	(25%)	(26%)	(33%)	(27%)	(30%)

(Continued)

MOS EPROM--Forecast

Table 5 (Continued)
Worldwide NMOS UV EPROM Market

	Average Selling Price (\$)							
	1986	1987	1988	1989	1990	1991	1992	1993
4K	0	0	0	0	0	0	0	0
8K	0	0	0	0	0	0	0	0
16K	\$ 2.40	\$ 2.62	\$ 3.22	\$ 3.55	\$ 3.60	\$3.80	\$4.05	\$4.20
32K	\$ 2.17	\$ 2.77	\$ 3.53	\$ 3.65	\$ 3.75	\$3.90	\$4.15	\$4.25
64K	\$ 2.49	\$ 3.00	\$ 3.85	\$ 3.85	\$ 3.85	\$3.95	\$4.20	\$4.30
128K	\$ 2.84	\$ 3.48	\$ 4.06	\$ 4.12	\$ 4.05	\$4.15	\$4.30	\$4.45
256K	\$ 4.65	\$ 4.42	\$ 4.62	\$ 4.40	\$ 4.25	\$4.35	\$4.45	\$4.55
512K	\$11.82	\$ 8.40	\$ 7.26	\$ 6.35	\$ 5.15	\$4.60	\$4.75	\$5.20
1Mb	\$48.50	\$24.32	\$22.06	\$18.00	\$11.20	\$8.80	\$7.45	\$7.30
2Mb	0	0	0	0	0	0	0	0
4Mb	0	0	0	0	0	0	0	0
8Mb	0	0	0	0	0	0	0	0
Overall ASP	\$ 3.24	\$ 4.18	\$ 4.86	\$ 5.09	\$ 4.62	\$4.42	\$4.50	\$4.63
% Change from Previous Year	(7%)	(29%)	16%	5%	(9%)	(4%)	2%	3%

Source: Dataquest
August 1989

MOS EPROM--Forecast

Table 6

Worldwide CMOS UV EPROM Market

	Millions of Dollars							
	1986	1987	1988	1989	1990	1991	1992	1993
4K	0	0	0	0	0	0	0	0
8K	0	0	0	0	0	0	0	0
16K	0	\$ 8	\$ 16	\$ 19	\$ 17	\$ 18	\$ 19	\$ 19
32K	\$ 7	10	8	9	13	13	13	13
64K	63	52	97	143	159	171	137	102
128K	7	45	73	89	82	62	60	57
256K	70	226	335	386	388	352	350	339
512K	4	75	164	234	228	199	169	165
1Mb	9	38	143	413	576	580	470	446
2Mb	0	0	0	11	24	86	389	546
4Mb	0	0	18	77	163	486	721	896
8Mb	0	0	0	0	0	0	5	136
Total	\$161	\$454	\$855	\$1,382	\$1,649	\$1,967	\$2,332	\$2,719
% Change from Previous Year	54%	181%	88%	62%	19%	19%	19%	17%

	Millions of Units							
	1986	1987	1988	1989	1990	1991	1992	1993
4K	0	0	0	0	0	0	0	0
8K	0	0	0	0	0	0	0	0
16K	0	2.4	3.1	4.3	4.1	4.4	4.5	4.5
32K	2.7	3.1	2.0	2.3	3.0	3.0	3.0	3.0
64K	16.3	15.8	23.7	34.0	37.0	39.3	31.0	22.6
128K	1.9	10.8	16.1	20.1	19.0	14.1	13.3	12.5
256K	14.1	43.9	63.6	83.1	87.7	78.2	75.3	71.0
512K	0.3	8.6	20.7	35.5	41.3	40.6	34.5	31.5
1Mb	0.1	1.4	7.5	29.0	52.0	65.2	61.8	59.8
2Mb	0	0	0	0.3	1.3	7.0	42.0	65.0
4Mb	0	0	0.2	1.7	6.2	32.0	70.0	106.0
8Mb	0	0	0	0	0	0	0.1	4.0
Total	35.3	86.0	136.8	210.3	251.6	283.8	335.5	379.9
% Change from Previous Year	76%	143%	59%	54%	20%	13%	18%	13%

(Continued)

MOS EPROM--Forecast

Table 6 (Continued)

Worldwide CMOS UV EPROM Market

	Average Selling Price (\$)							
	1986	1987	1988	1989	1990	1991	1992	1993
4K	0	0	0	0	0	0	0	0
8K	0	0	0	0	0	0	0	0
16K	0	\$ 3.36	\$ 5.08	\$ 4.50	\$ 4.20	\$ 4.10	\$ 4.20	\$ 4.20
32K	\$ 2.71	\$ 3.08	\$ 3.81	\$ 3.90	\$ 4.30	\$ 4.20	\$ 4.20	\$ 4.25
64K	\$ 3.87	\$ 3.30	\$ 4.10	\$ 4.20	\$ 4.30	\$ 4.35	\$ 4.42	\$ 4.50
128K	\$ 3.94	\$ 4.15	\$ 4.55	\$ 4.45	\$ 4.32	\$ 4.40	\$ 4.48	\$ 4.58
256K	\$ 4.98	\$ 5.15	\$ 5.27	\$ 4.65	\$ 4.42	\$ 4.50	\$ 4.65	\$ 4.78
512K	\$14.08	\$ 8.69	\$ 7.95	\$ 6.60	\$ 5.51	\$ 4.90	\$ 4.90	\$ 5.25
1Mb	\$62.62	\$28.27	\$19.21	\$14.25	\$11.08	\$ 8.90	\$ 7.60	\$ 7.45
2Mb	0	0	0	\$35.00	\$18.45	\$12.25	\$ 9.26	\$ 8.40
4Mb	0	0	\$80.00	\$45.00	\$26.25	\$15.20	\$10.30	\$ 8.45
8Mb	0	0	0	0	0	\$90.00	\$50.00	\$34.00
Overall ASP	\$ 4.57	\$ 5.28	\$ 6.25	\$ 6.57	\$ 6.56	\$ 6.93	\$ 6.95	\$ 7.16
% Change from Previous Year	(12%)	16%	18%	5%	0	6%	0	3%

Source: Dataquest
August 1989

MOS EPROM--Forecast

Table 7

Worldwide MOS OTP EPROM Market--Total (NMOS and CMOS)

	Millions of Dollars							
	1986	1987	1988	1989	1990	1991	1992	1993
4K	0	0	0	0	0	0	0	0
8K	0	0	0	0	0	0	0	0
16K	0	0	0	0	0	0	0	0
32K	\$ 1	0	0	0	0	0	0	0
64K	12	\$ 51	\$ 21	\$ 16	\$ 10	\$ 5	\$ 2	0
128K	12	21	20	14	8	3	1	0
256K	46	65	61	47	32	24	21	\$ 17
512K	0	14	35	78	65	54	47	44
1Mb	0	0	5	34	94	141	144	123
2Mb	0	0	0	0	1	29	58	111
4Mb	0	0	0	0	17	48	87	140
Total	\$72	\$151	\$142	\$188	\$227	\$305	\$359	\$435
% Change from Previous Year	259%	111%	(6%)	32%	20%	35%	18%	21%

	Millions of Units							
	1986	1987	1988	1989	1990	1991	1992	1993
4K	0	0	0	0	0	0	0	0
8K	0	0	0	0	0	0	0	0
16K	0	0	0	0	0	0	0	0
32K	0.9	0	0	0	0	0	0	0
64K	5.7	19.3	6.5	4.9	3.0	1.6	0.5	0
128K	5.2	7.2	6.2	4.1	2.4	1.0	0.2	0
256K	12.5	17.6	15.5	13.0	9.3	6.9	5.7	4.5
512K	0	1.8	6.0	15.0	15.7	14.0	12.1	10.5
1Mb	0	0	0.3	3.0	11.0	20.0	24.0	23.5
2Mb	0	0	0	0	0.1	3.0	8.0	17.0
4Mb	0	0	0	0	0.8	4.0	11.0	20.0
Total	24.2	46.0	34.5	40.0	42.3	50.5	61.5	75.5
% Change from Previous Year	192%	90%	(25%)	16%	6%	19%	22%	23%

(Continued)

MOS EPROM--Forecast

Table 7 (Continued)

Worldwide MOS OTP EPROM Market—Total (NMOS and CMOS)

	Average Selling Price (\$)							
	1986	1987	1988	1989	1990	1991	1992	1993
4K	0	0	0	0	0	0	0	0
8K	0	0	0	0	0	0	0	0
16K	0	0	0	0	0	0	0	0
32K	\$ 1.75	0	0	0	0	0	0	0
64K	\$ 2.01	\$2.64	\$ 3.17	\$ 3.22	\$ 3.23	\$ 3.39	\$3.49	0
128K	\$ 2.27	\$2.92	\$ 3.31	\$ 3.38	\$ 3.32	\$ 3.40	\$3.52	0
256K	\$ 3.73	\$3.67	\$ 3.96	\$ 3.64	\$ 3.43	\$ 3.51	\$3.64	\$3.78
512K	\$10.19	\$7.56	\$ 5.89	\$ 5.17	\$ 4.13	\$ 3.83	\$3.89	\$4.18
1Mb	0	0	\$15.30	\$11.22	\$ 8.56	\$ 7.05	\$6.00	\$5.25
2Mb	0	0	0	0	\$14.50	\$ 9.70	\$7.25	\$6.55
4Mb	0	0	0	0	\$20.80	\$12.10	\$7.88	\$6.99
Overall ASP	\$ 2.95	\$3.27	\$ 4.13	\$ 4.71	\$ 5.36	\$ 6.04	\$5.84	\$5.77

Source: Dataquest
August 1989

MOS EPROM--Forecast

Table 8

Worldwide NMOS OTP EPROM Market

	<u>Millions of Dollars</u>							
	<u>1986</u>	<u>1987</u>	<u>1988</u>	<u>1989</u>	<u>1990</u>	<u>1991</u>	<u>1992</u>	<u>1993</u>
4K	0	0	0	0	0	0	0	0
8K	0	0	0	0	0	0	0	0
16K	0	0	0	0	0	0	0	0
32K	\$ 1	0	0	0	0	0	0	0
64K	10	\$ 19	\$10	\$ 6	\$ 3	\$ 1	0	0
128K	12	20	14	8	4	1	0	0
256K	38	52	23	14	10	7	\$ 5	\$ 4
512K	0	13	28	52	28	19	14	12
1Mb	0	0	0	0	0	0	0	0
2Mb	0	0	0	0	0	0	0	0
4Mb	0	0	0	0	0	0	0	0
Total	\$61	\$105	\$76	\$80	\$45	\$29	\$19	\$16
% Change from Previous Year	266%	72%	(28)	5	(44)	(36)	(32)	(19)

	<u>Millions of Units</u>							
	<u>1986</u>	<u>1987</u>	<u>1988</u>	<u>1989</u>	<u>1990</u>	<u>1991</u>	<u>1992</u>	<u>1993</u>
4K	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
8K	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
16K	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
32K	0.9	N/A	N/A	N/A	N/A	N/A	N/A	N/A
64K	4.9	7.9	3.2	1.9	1.0	0.4	0	0
128K	5.2	6.8	4.5	2.3	1.2	0.4	0	0
256K	10.4	14.7	6.3	4.1	3.0	2.1	1.5	1.0
512K	0	1.8	4.9	10.0	7.0	5.0	3.6	3.0
1Mb	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2Mb	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
4Mb	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total	21.4	31.2	18.8	18.3	12.2	7.9	5.1	4.0

(Continued)

MOS EPROM--Forecast

Table 8 (Continued)

Worldwide NMOS OTP EPROM Market

	Average Selling Price (\$)							
	1986	1987	1988	1989	1990	1991	1992	1993
4K	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
8K	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
16K	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
32K	\$ 1.75	N/A	N/A	N/A	N/A	N/A	N/A	N/A
64K	\$ 1.96	\$2.42	\$3.08	\$3.10	\$2.90	\$3.22	0	0
128K	\$ 2.27	\$2.90	\$3.20	\$3.25	\$3.20	\$3.28	0	0
256K	\$ 3.63	\$3.58	\$3.68	\$3.50	\$3.40	\$3.40	\$3.60	\$3.70
512K	\$10.00	\$7.55	\$5.80	\$5.20	\$4.00	\$3.80	\$3.90	\$4.00
1Mb	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2Mb	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
4Mb	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Overall ASP	\$ 2.85	\$3.36	\$4.02	\$4.36	\$3.68	\$3.64	\$3.81	\$3.93

N/A = Not Available

Source: Dataquest
August 1989

MOS EPROM--Forecast

Table 9

Worldwide CMOS OTP EPROM Market

	Millions of Dollars							
	<u>1986</u>	<u>1987</u>	<u>1988</u>	<u>1989</u>	<u>1990</u>	<u>1991</u>	<u>1992</u>	<u>1993</u>
4K	0	0	0	0	0	0	0	0
8K	0	0	0	0	0	0	0	0
16K	0	0	0	0	0	0	0	0
32K	0	0	0	0	0	0	0	0
64K	\$ 2	\$32	\$11	\$ 10	\$ 7	\$ 4	\$ 2	0
128K	0	1	6	6	4	2	1	0
256K	9	12	38	33	22	17	15	\$ 13
512K	0	0	7	26	37	35	33	32
1Mb	0	0	5	34	94	141	144	123
2Mb	0	0	0	0	1	29	58	111
4Mb	0	0	0	0	17	48	87	140
Total	\$11	\$46	\$67	\$109	\$182	\$276	\$339	\$420
% Change from Previous Year	228%	330%	46%	63%	67%	52%	23%	24%

	Millions of Units							
	<u>1986</u>	<u>1987</u>	<u>1988</u>	<u>1989</u>	<u>1990</u>	<u>1991</u>	<u>1992</u>	<u>1993</u>
4K	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
8K	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
16K	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
32K	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
64K	0.8	11.4	3.3	3.0	2.0	1.2	0.5	0
128K	0	0.4	1.7	1.8	1.2	0.6	0.2	0
256K	2.1	3.0	9.2	8.9	6.3	4.8	4.2	3.5
512K	0	0.1	1.1	5.0	8.7	9.0	8.5	7.5
1Mb	0	0	0.3	3.0	11.0	20.0	24.0	23.5
2Mb	N/A	N/A	N/A	0	0.1	3.0	8.0	17.0
4Mb	N/A	N/A	N/A	0	0.8	4.0	11.0	20.0
Total	2.9	14.8	15.6	21.7	30.1	42.6	56.4	71.5

(Continued)

MOS EPROM--Forecast

Table 9 (Continued)

Worldwide CMOS OTP EPROM Market

	Average Selling Price (\$)							
	1986	1987	1988	1989	1990	1991	1992	1993
4K	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
8K	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
16K	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
32K	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
64K	\$ 2.35	\$2.80	\$ 3.25	\$ 3.30	\$ 3.40	\$ 3.44	\$3.49	0
128K	\$ 2.89	\$3.20	\$ 3.60	\$ 3.55	\$ 3.43	\$ 3.48	\$3.52	0
256K	\$ 4.22	\$4.10	\$ 4.15	\$ 3.71	\$ 3.45	\$ 3.56	\$3.65	\$ 3.80
512K	\$11.30	\$7.90	\$ 6.30	\$ 5.12	\$ 4.24	\$ 3.85	\$3.88	\$ 4.25
1Mb	N/A	N/A	\$15.30	\$11.22	\$ 8.56	\$ 7.05	\$6.00	\$ 5.25
2Mb	N/A	N/A	N/A	N/A	\$14.50	\$ 9.70	\$7.25	\$ 6.55
4Mb	N/A	N/A	N/A	0	\$20.80	\$12.10	\$7.88	\$ 6.99
Overall ASP	\$ 3.71	\$3.09	\$ 4.27	\$ 5.00	\$ 6.04	\$ 6.49	\$6.02	\$ 5.87

N/A = Not Available

Source: Dataquest
August 1989

MOS EPROM--Forecast

THE MARKET—1988

Worldwide MOS EPROM revenue totaled \$1.87 billion in 1988, growing 38 percent in revenue over a 1987 total of \$1.35 billion, with strong growth expected to continue through 1989. Intel maintained its lead with more than 18.0 percent unit share of the worldwide market, followed by SGS-Thomson with 12.6 percent unit share. In 1988, worldwide reported units increased to 350.7 million, 13.0 percent over the 310.1 million units shipped in 1987. Although CMOS technology continued to garner share from NMOS during 1988, the most significant changes in 1988 were product shortages and higher average selling prices (ASPs) in key EPROM densities.

COMPARISON WITH EARLIER FORECASTS

The current Dataquest EPROM forecast contains several significant differences from our July 1988 forecast. The changes and reasons for these differences are as follows:

- Actual revenue, unit shipments, and ASPs for 1987 have been adjusted to reflect final numbers that were completed by the middle of 1988.
- Actual bit shipments increased 44 percent as a result of continued strong growth in the 256K and 512K densities.
- The NMOS share of EPROMs continued to decline, representing 56.5 percent of all EPROM units shipped in 1988 (down from 67.5 percent in 1987) and 85.8 percent share of units in 1986.
- U.S. manufacturers' share of the EPROM market increased for a second consecutive year, reaching 51.3 percent, while Japanese manufacturers' share dropped to 39.6 percent and European manufacturers' share grew to 13.2 percent.
- Shipments of high-speed 16K through 1Mb CMOS devices continued to increase in 1988. As a result, Dataquest increased its unit forecasts and extended the life cycle forecasts of the 16K, 64K, and 256K EPROMs.

MARKET OUTLOOK

Although worldwide EPROM production and shipments grew 13 percent in 1988, strong demand and continued high ASPs were the greatest contributors to strong revenue growth in 1988. Although U.S. and European EPROM suppliers continued to benefit from MITI-imposed production reductions, EPROM users were forced to endure product shortages, long lead times, and very high prices in the 64K through 512K densities during the first three quarters of 1988. ASPs increased 22 percent overall in 1988,

MOS EPROM--Forecast

averaging out at \$5.33. This price is in comparison with \$4.35 in 1987. The fourth quarter of 1988 saw EPROM prices softening from the 1Mb 128Kx8 configurations, down through the 64K densities as a result of increased capacity from the U.S. and European manufacturers. As MITI continued to impose production cutback guidelines for memory suppliers in Japan, Fujitsu and Mitsubishi followed in the path of Hitachi, NEC, Oki and Toshiba, drastically slowing down and/or stopping quarter-to-quarter production of their 64K, 128K, and 256K EPROMs. These suppliers give very little indication that they will return to the low-density EPROM arena. Dataquest expects these manufacturers to redirect their focus into the extremely high-speed, high-density market during the next six quarters for a large ramp-up in production that could promote very strong nonvolatile memory growth from 1991 through 1993.

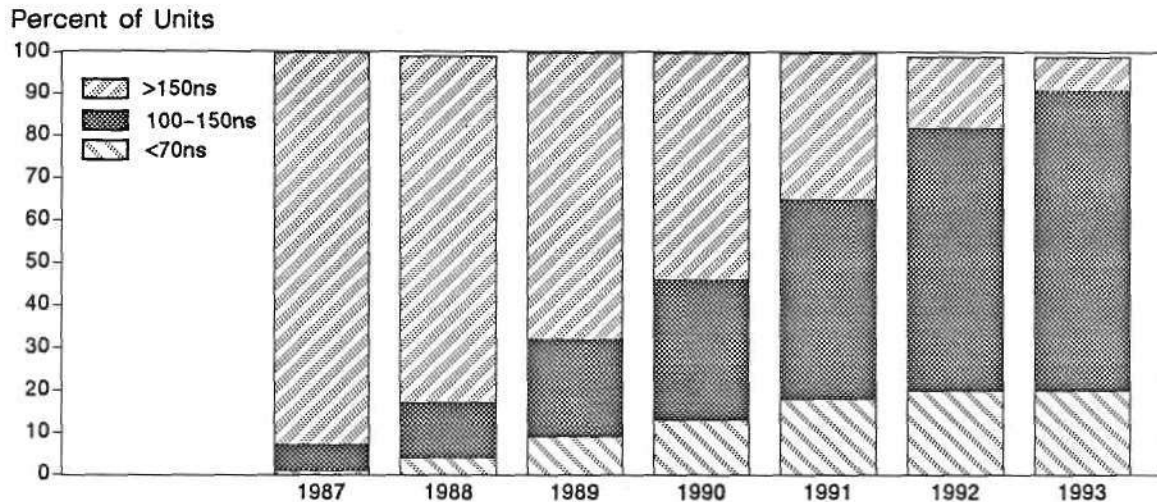
High-Speed EPROMs

Figure 1 illustrates Dataquest's estimate of the 1989 to 1993 high-speed EPROM market as a percentage of total units. The very high speed (less than 70ns) products, which now have speeds averaging 20 to 55ns, continue to be driven by the low-speed 8K, 16K, and 64K devices. These low-density, high-speed products are designed for very specific bipolar PROM replacement applications. The 55 to 100ns or high-speed arena saw many developments in the 256K through 4Mb EPROMs to accommodate high-speed developments in the 16-bit/32-bit MPUs. A few of these include 1988 ISSCC announcements of new products such as Intel's 90ns 4Mb CMOS EPROM, Hitachi's 55ns 64Kx16 device, and SGS-Thomson's 70ns 64Kx16 device. We continue to believe that the 100 to 150ns range will be the most prevalent EPROM speed range by 1992, with ramp-up in volume production beginning in the latter part of 1990. Although 64K and 256K densities sustained the largest growth for demands of high speed and very high speed in 1988, production grew in densities of 512K and more in the first quarter of 1989, and continued growth is expected through the end of the year.

MOS EPROM--Forecast

Figure 1

High-Speed EPROM Market Forecast



0004718-1

Source: Dataquest
August 1989

CMOS/NMOS EPROMs

CMOS technology represented a 51 percent share of total EPROM production in 1988, surpassing Dataquest's previous projection of a 45 percent share. As such, we expect the CMOS share to continue growing, surpassing NMOS with a more than 52 percent share of units by the end of 1989 and an expected 71 percent share of the total market by the end of 1990. The 64K and 256K devices maintained the strongest density share of the entire EPROM product lineup in 1988, with respective shares of 41 and 55 percent.

MOS UV/OTP EPROMs

Table 4 shows EPROMs packaged in UV erasable packages, while Table 7 deals strictly with production of one-time programmable (OTP) EPROMs in plastic packages without windows.

Dataquest consistently has made the packaging distinction between EPROMs in UV erasable packages and those in nonerasable plastic packages, or OTPs, for the primary reason of separately tracking an anticipated shift to less expensive packages. Our forecast for 1988 through 1993 shows that UV EPROMs will continue to have a larger share of the EPROM market. The OTP EPROM product has continued to maintain a marginal and declining share of the EPROM market. Product introduction and product

MOS EPROM--Forecast

demand continue to come from densities of 256K and more. Although OTP represented a 14.8 percent share of the EPROM market in 1987, its 1988 share dropped to 10.0 percent, with an expected 10.0 percent share of the total market by the end of 1989. We expect that AMD, Mitsubishi, Sharp, Texas Instruments, and Toshiba will continue to be the major OTP suppliers, with a predominant shift to CMOS occurring during the 1990 through 1993 time frame.

Flash Memory

Flash memory technology is a new, nonvolatile memory product area that will be covered in a separate section of Dataquest's semiconductor memories notebook. Further information on flash memory technology can be found in Dataquest's SIS newsletter, "The Bare Facts About Flash," published in June 1989.

Short-Term Forecast

Dataquest believes that the EPROM pricing softness that occurred during the first two quarters of 1989 will continue through the end of the year. The price declines currently are affecting the 64K through 1Mb densities, with the most aggressive pricing occurring at the 256K level, where prices have been quoted at less than \$2. Although 1Mb EPROM unit shipments reached 9 million in 1988 as Japanese vendors captured more than 79.4 percent of market share, up from 75.0 percent in 1987, 1Mb unit shipments fell far below our expected forecast for the second consecutive year. Although user interest in the 1Mb product is high and shipments of both x8 and x16 configurations have been strong through the first two quarters of 1989, it is questionable that 1Mb EPROMs will reach market expectations of 37 million units by the end of 1989.

LONG-TERM FORECAST

Dataquest believes that the slow bit growth that has occurred since 1987 will continue through the first half of 1990. A slow but positive upturn is expected to begin during the second half of 1990, with a rapid ramp-up in production in 1991 that will continue through 1993, as demand for 1Mb through 4Mb densities increases. Bit growth is expected to have a compound annual growth rate (CAGR) of 57.7 percent from 1988 through 1993. The automotive and electronic data processing segments continue to be the strongest drivers for bit growth in the 1991 through 1993 time frame.

Although product sampling and shipment of the 2Mb and 4Mb EPROMs has been minimal during the first half of 1989, increased shipments are expected from all participants during the second half of 1990. Although strong user demand and supplier support are expected for 2Mb EPROMs in both the x8 and x16 configurations, we believe that the 4Mb will be the next area of major growth for the EPROM sector. Table 10 lists all of the known 2Mb and 4Mb participants and their products by organization.

MOS EPROM--Forecast

Table 10

1989 2Mb/4Mb CMOS EPROM Suppliers

<u>Company</u>	<u>Fastest Speed</u>	<u>2Mb</u>		<u>4Mb</u>	
		<u>x8</u>	<u>x16</u>	<u>x8</u>	<u>x16</u>
AMD	100ns		X		
	120ns				X
Fujitsu	150ns			X	X
Intel	150ns	X	X		X
Mitsubishi	100ns	X	X		
	120ns				X
NEC	150ns	X		X	
Toshiba	150ns			X	
WaferScale	100ns				X

Source: Dataquest
August 1989

Although EPROM revenue is expected to exceed \$2.3 billion in 1990, its expected growth in units and dollars during 1989 will be marginal; 24 suppliers will be scurrying for a share of that 1990 commodity market. With densities now ranging from 16K through 4Mb and increased user demands for a variety of speeds, varying organizations, and packages, Dataquest anticipates that successful market share gains will be made only by the broad-based and/or very focused high-speed suppliers during the expected 1990 slowdown.

MOS ROM--Forecast

MOS ROMS—TOTAL WORLDWIDE FORECAST

Dataquest's MOS ROM forecast consists of revenue, unit shipments, and prices for MOS ROM product lines. Table 1 is the top-level market estimate for the tables in the forecast.

Included in our tables are all Mask ROMs, whether used for software storage, character generators, or keyboard encoders. Revenue listed is total revenue generated from the sale of ROM products, regardless of the technology employed (NMOS or CMOS), including mask charges that are amortized over the entire production run. Tables contained in this forecast are shown as follows:

- Table 1—Worldwide Market Forecast—Total MOS ROMs
- Table 2—Worldwide NMOS ROM Market Forecast
- Table 3—Worldwide CMOS ROM Market Forecast

The Market—1988

Dataquest estimates that worldwide MOS ROM revenue totaled \$989 million in 1988, growing by 49 percent over the \$663 million market in 1987. Unit shipments increased more than 29 percent to 250.3 million units. A major shift by users from the mature 512K and below densities to the 1Mb-and-above densities occurred from 1987 through 1988. Notable changes in the ROM market in 1988 included the following:

- Increased demand for the 1Mb and 4Mb ROMs from the consumer and electronic data process markets (EDP) in both Japan and the United States created severe shortages and high prices for end users during 1988.
- CMOS ROMs continued to gain unit share over NMOS. CMOS units represented more than 87 percent of the total ROMs produced worldwide in 1988.

MOS ROM--Forecast

Table 1

Worldwide Market Forecast--Total MOS ROMs

	Value (Millions of Dollars)							
	1986	1987	1988	1989	1990	1991	1992	1993
4K	0	0	0	0	0	0	0	0
8K	\$ 3	0	0	0	0	0	0	0
16K	8	\$ 4	\$ 2	\$ 1	0	0	0	0
32K	18	19	18	11	\$ 7	\$ 3	\$ 1	0
64K	42	38	36	30	22	11	2	0
128K	48	32	16	7	2	1	0	0
256K	154	94	67	46	28	17	9	\$ 5
512K	52	114	101	106	67	42	23	14
1Mb	95	284	347	220	109	73	50	38
2Mb	9	56	215	307	361	205	109	69
4Mb	3	22	186	392	432	495	308	200
8Mb	0	0	1	11	116	259	429	486
16Mb	0	0	0	1	24	167	435	483
32Mb	0	0	0	0	1	9	84	266
64Mb	0	0	0	0	0	0	1	10
Total	\$432	\$663	\$989	\$1,132	\$1,169	\$1,281	\$1,451	\$1,572

Percent Change
from Previous
Year

8% 54% 49% 15% 3% 10% 13% 8%

	Units (Millions)							
	1986	1987	1988	1989	1990	1991	1992	1993
4K	0	0	0	0	0	0	0	0
8K	1.0	0	0	0	0	0	0	0
16K	3.0	1.7	0.8	0.2	0	0	0	0
32K	11.8	12.7	11.3	7.0	4.5	2.0	0.5	0
64K	28.0	24.7	22.4	18.0	13.0	6.0	1.0	0
128K	27.0	18.0	9.6	4.0	1.0	0.3	0.1	0
256K	68.0	46.5	34.5	25.0	15.2	9.0	4.8	2.8
512K	9.0	27.7	31.3	39.0	28.0	19.0	11.0	6.5
1Mb	12.0	54.7	84.6	58.0	34.0	26.0	20.0	16.0
2Mb	0.4	6.4	37.1	58.0	84.0	54.0	32.0	22.0
4Mb	0.1	1.4	18.6	49.0	72.0	97.0	70.0	50.0
8Mb	0	0	0.1	1.0	14.0	37.0	74.0	90.0
16Mb	0	0	0	0.1	2.0	18.0	55.0	68.0
32Mb	0	0	0	0	0	0.2	3.1	14.0
64Mb	0	0	0	0	0	0	0	0.2
Total	160.3	193.8	250.3	259.3	267.7	268.5	271.5	269.5

(Continued)

MOS ROM--Forecast

Table 1 (Continued)

Worldwide Market Forecast--Total MOS ROMs

	Average Selling Price (Dollars/Unit)							
	1986	1987	1988	1989	1990	1991	1992	1993
4K	0	0	0	0	0	0	0	0
8K	\$ 3.25	0	0	0	0	0	0	0
16K	\$ 2.50	\$ 2.50	\$ 2.50	\$ 2.50	0	0	0	0
32K	\$ 1.50	\$ 1.50	\$ 1.55	\$ 1.60	\$ 1.60	\$ 1.65	\$ 1.65	0
64K	\$ 1.50	\$ 1.55	\$ 1.62	\$ 1.65	\$ 1.70	\$ 1.75	\$ 1.75	0
128K	\$ 1.79	\$ 1.75	\$ 1.65	\$ 1.70	\$ 1.75	\$ 1.80	\$ 1.80	0
256K	\$ 2.26	\$ 2.03	\$ 1.94	\$ 1.85	\$ 1.85	\$ 1.85	\$ 1.85	\$ 1.85
512K	\$ 5.83	\$ 4.10	\$ 3.23	\$ 2.72	\$ 2.38	\$ 2.21	\$ 2.12	\$ 2.15
1Mb	\$ 7.88	\$ 5.19	\$ 4.10	\$ 3.80	\$ 3.20	\$ 2.80	\$ 2.52	\$ 2.40
2Mb	\$23.00	\$ 8.75	\$ 5.80	\$ 5.30	\$ 4.30	\$ 3.80	\$ 3.40	\$ 3.15
4Mb	\$32.00	\$16.00	\$10.00	\$ 8.00	\$ 6.00	\$ 5.10	\$ 4.40	\$ 4.00
8Mb	0	\$34.00	\$18.00	\$11.00	\$ 8.30	\$ 7.00	\$ 5.80	\$ 5.40
16Mb	0	\$70.00	\$38.00	\$23.00	\$12.00	\$ 9.30	\$ 7.90	\$ 7.10
32Mb	0	0	0	0	\$80.00	\$44.00	\$27.00	\$19.00
64Mb	0	0	0	0	0	0	\$98.00	\$51.00
Overall ASP	\$ 2.69	\$ 3.42	\$ 3.95	\$ 4.37	\$ 4.37	\$ 4.77	\$ 5.34	\$ 5.83

Source: Dataquest
October 1989

MOS ROM--Forecast

Table 2

Worldwide NMOS ROM Market Forecast

	Value (Millions of Dollars)							
	1986	1987	1988	1989	1990	1991	1992	1993
4K	0	0	0	0	0	0	0	0
8K	0	0	0	0	0	0	0	0
16K	\$ 6	\$ 3	\$ 1	0	0	0	0	0
32K	15	15	16	\$11	\$ 7	\$3	\$1	0
64K	31	18	15	5	2	0	0	0
128K	34	10	7	2	0	0	0	0
256K	100	19	15	7	4	2	0	0
512K	23	0	0	0	0	0	0	0
1Mb	39	0	0	0	0	0	0	0
2Mb	0	0	0	0	0	0	0	0
4Mb	0	0	0	0	0	0	0	0
8Mb	0	0	0	0	0	0	0	0
16Mb	0	0	0	0	0	0	0	0
32Mb	0	0	0	0	0	0	0	0
64Mb	0	0	0	0	0	0	0	0
Total	\$248	\$65	\$53	\$26	\$13	\$5	\$1	0

Percent Change
from Previous
Year

(74%) (19%) (51%) (51%) (59%) (84%) (100%)

	Units (Millions)							
	1986	1987	1988	1989	1990	1991	1992	1993
4K	0	0	0	0	0	0	0	0
8K	0	0	0	0	0	0	0	0
16K	2.5	1.2	0.3	0	0	0	0	0
32K	10.0	10.0	10.0	7.0	4.5	2.0	0.5	0
64K	20.4	11.6	9.4	3.3	1.0	0	0	0
128K	19.0	5.6	4.0	1.0	0	0	0	0
256K	44.2	9.5	7.7	4.0	2.0	1.0	0	0
512K	4.0	0	0	0	0	0	0	0
1Mb	5.0	0	0	0	0	0	0	0
2Mb	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
4Mb	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
8Mb	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
16Mb	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
32Mb	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
64Mb	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total	105.1	37.9	31.4	15.3	7.5	3.0	0.5	0

(Continued)

MOS ROM--Forecast

Table 2 (Continued)
Worldwide NMOS ROM Market Forecast

	Average Selling Price (Dollars/Unit)							
	1986	1987	1988	1989	1990	1991	1992	1993
4K	0	0	0	0	0	0	0	0
8K	0	0	0	0	0	0	0	0
16K	\$2.50	\$2.50	\$2.50	\$2.50	0	0	0	0
32K	\$1.50	\$1.50	\$1.55	\$1.60	\$1.60	\$1.65	\$1.65	0
64K	\$1.50	\$1.55	\$1.62	\$1.65	\$1.70	0	0	0
128K	\$1.79	\$1.75	\$1.65	\$1.70	0	0	0	0
256K	\$2.26	\$2.03	\$1.94	\$1.85	\$1.85	\$1.85	0	0
512K	\$5.83	0	0	0	0	0	0	0
1Mb	\$7.88	0	0	0	0	0	0	0
2Mb	0	0	0	0	0	0	0	0
4Mb	0	0	0	0	0	0	0	0
8Mb	0	0	0	0	0	0	0	0
16Mb	0	0	0	0	0	0	0	0
32Mb	0	0	0	0	0	0	0	0
64Mb	0	0	0	0	0	0	0	0
Overall ASP	\$2.36	\$1.72	\$1.69	\$1.68	\$1.68	\$1.72	\$1.65	0

Source: Dataquest
October 1989

MOS ROM--Forecast

Table 3

Worldwide CMOS ROM Market Forecast

	Value (Millions of Dollars)									
	1986	1987	1988	1989	1990	1991	1992	1993		
4K	0	0	0	0	0	0	0	0		
8K	\$ 3	0	0	0	0	0	0	0		
16K	1	\$ 1	\$ 1	\$ 1	0	0	0	0		
32K	3	4	2	0	0	0	0	0		
64K	11	20	21	24	\$ 20	\$ 11	\$ 2	0		
128K	14	22	9	5	2	1	0	0		
256K	54	75	52	39	24	15	9	5		
512K	29	114	101	106	67	42	23	14		
1Mb	55	284	347	220	109	73	50	38		
2Mb	9	56	215	307	361	205	109	69		
4Mb	3	22	186	392	432	495	308	200		
8Mb	0	0	1	11	116	259	429	486		
16Mb	0	0	0	1	24	167	435	483		
32Mb	0	0	0	0	1	9	84	266		
64Mb	0	0	0	0	0	0	2	10		
Total	\$183	\$598	\$936	\$1,107	\$1,156	\$1,276	\$1,451	\$1,572		
Percent Change from Previous Year		226%	56%	18%	4%	10%	14%	8%		

	Units (Millions)									
	1986	1987	1988	1989	1990	1991	1992	1993		
4K	0	0	0	0	0	0	0	0		
8K	1.0	0	0	0	0	0	0	0		
16K	0.5	0.5	0.5	0.2	0	0	0	0		
32K	1.8	2.7	1.3	0	0	0	0	0		
64K	7.6	13.1	13.0	14.7	12.0	6.0	1.0	0		
128K	8.0	12.4	5.6	3.0	1.0	0.3	0.1	0		
256K	23.8	37.0	26.8	21.0	13.2	8.0	4.8	2.8		
512K	5.0	27.7	31.3	39.0	28.0	19.0	11.0	6.5		
1Mb	7.0	54.7	84.6	58.0	34.0	26.0	20.0	16.0		
2Mb	0.4	6.4	37.1	58.0	84.0	54.0	32.0	22.0		
4Mb	0.1	1.4	18.6	49.0	72.0	97.0	70.0	50.0		
8Mb	N/A	0	0.1	1.0	14.0	37.0	74.0	90.0		
16Mb	N/A	N/A	0	0.1	2.0	18.0	55.0	68.0		
32Mb	N/A	N/A	N/A	N/A	0	0.2	3.1	14.0		
64Mb	N/A	N/A	N/A	N/A	N/A	N/A	0	0.2		
Total	55.2	155.9	218.9	244.0	260.2	265.5	271.0	269.5		

(Continued)

MOS ROM--Forecast

Table 3 (Continued)

Worldwide CMOS ROM Market Forecast

	Average Selling Price (Dollars/Unit)							
	1986	1987	1988	1989	1990	1991	1992	1993
4K	0	0	0	0	0	0	0	0
8K	\$ 3.25	0	0	0	0	0	0	0
16K	\$ 2.50	\$ 2.50	\$ 2.50	\$ 2.50	0	0	0	0
32K	\$ 1.50	\$ 1.50	\$ 1.55	\$ 1.60	\$ 1.60	\$ 1.65	\$ 1.65	0
64K	\$ 1.50	\$ 1.55	\$ 1.62	\$ 1.65	\$ 1.70	\$ 1.75	\$ 1.75	0
128K	\$ 1.79	\$ 1.75	\$ 1.65	\$ 1.70	\$ 1.75	\$ 1.80	\$ 1.80	0
256K	\$ 2.26	\$ 2.03	\$ 1.94	\$ 1.85	\$ 1.85	\$ 1.85	\$ 1.85	\$ 1.85
512K	\$ 5.83	\$ 4.10	\$ 3.23	\$ 2.72	\$ 2.38	\$ 2.21	\$ 2.12	\$ 2.15
1Mb	\$ 7.88	\$ 5.19	\$ 4.10	\$ 3.80	\$ 3.20	\$ 2.80	\$ 2.52	\$ 2.40
2Mb	\$23.00	\$ 8.75	\$ 5.80	\$ 5.30	\$ 4.30	\$ 3.80	\$ 3.40	\$ 3.15
4Mb	\$32.00	\$16.00	\$10.00	\$ 8.00	\$ 6.00	\$ 5.10	\$ 4.40	\$ 4.00
8Mb	0	\$34.00	\$18.00	\$11.00	\$ 8.30	\$ 7.00	\$ 5.80	\$ 5.40
16Mb	0	\$70.00	\$38.00	\$23.00	\$12.00	\$ 9.30	\$ 7.90	\$ 7.10
32Mb	0	0	0	0	\$80.00	\$44.00	\$27.00	\$19.00
64Mb	0	0	0	0	0	0	\$98.00	\$51.00
Overall ASP	\$ 3.32	\$ 3.84	\$ 4.28	\$ 4.54	\$ 4.44	\$ 4.81	\$ 5.35	\$ 5.83

Source: Dataquest
October 1989

MOS ROM--Forecast

Comparison with Earlier Forecast

The present MOS ROM forecast contains several significant changes from the earlier Dataquest ROM forecast, published in June 1988. The changes and reasons for these differences are as follows:

- Adjustments have been made to the 1986 and 1987 actual unit data based on updated data base information. As a result, the actual 1988 revenue far surpassed our previously forecast \$496 million.
- CMOS share of ROM is expected to continue absorbing the larger share of the ROM market, with NMOS declining and finally becoming obsolete by 1993. Virtually every manufacturer is producing CMOS ROM in all densities, with CMOS being the sole process technology used in next-generation product development.

Market Outlook

Dataquest saw continued market growth for more dense, very high speed ROMs (typically 150ns and below) for use in new laser printers, electronic video game computers, high-speed electronic typewriters, and ROM-supported cache systems.

CMOS/NMOS

As indicated in the 1988 forecast, CMOS has grown significantly over NMOS. As demand continues for larger memory capacity, higher speed, and low power, we anticipate that CMOS will command the larger portion of total ROM unit share. CMOS is becoming the dominant technology in all of the MOS memory areas and as such, will follow the same path to growth in the mask ROM area. Dataquest expects a complete displacement of NMOS ROMs during the next few years, as illustrated in Figure 1.

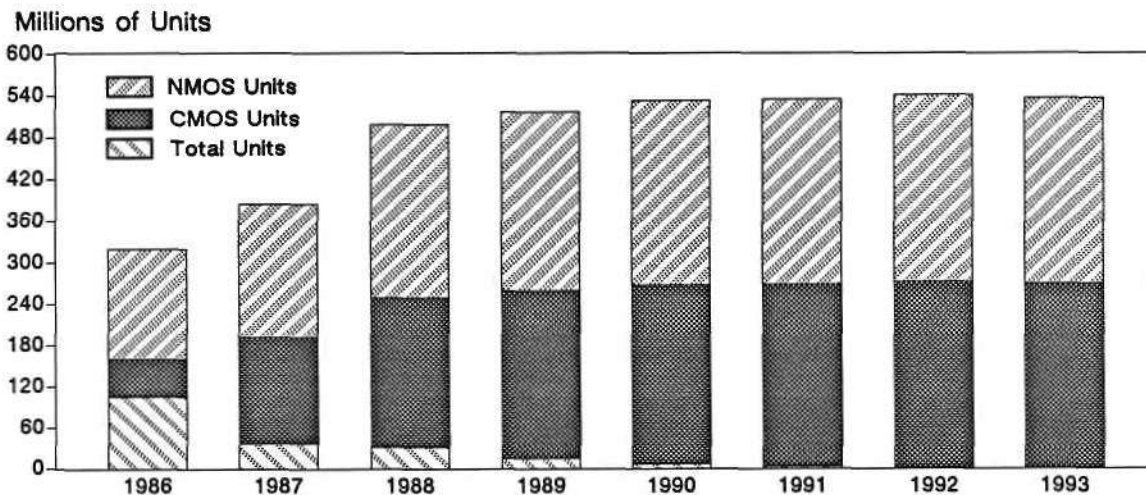
Short-Term Forecast

Strong market growth is projected for ROMs through the end of 1989, driven primarily by increased user demand for high-density, high-speed products. Although the 256K-and-below densities continued the expected decline in their life cycles, shipments of the 512K-and-above grew tremendously in 1988. The high-density products contributed significantly to the 49 percent growth in revenue in 1988, with an expected continued growth in revenue of 15 percent in 1989 over 1988. As ROM usage increased in the EDP sector for office automation systems in both Japan and the United States, suppliers shifted production to the 1Mb and 4Mb designs.

MOS ROM--Forecast

Figure 1

CMOS/NMOS ROM Growth (Total Units)



0004881-1

Source: Dataquest
October 1989

Although the 512K density continued to grow, driven primarily by U.S. users, increased demand for 1Mb and 4Mb designs from Nintendo in Japan and office automation users in the United States, and lack of capacity drove 1Mb and 4Mb prices to astronomical heights during the third and fourth quarters of 1988 and during the first half of 1989. U.S. office system usage was the greatest contributor to 1Mb product growth in 1988. As U.S. users shifted from 512K to the 1Mb and 4Mb devices, their demand for high speed followed. Office automation system design upgrades for 1990 products are expected to boost shipments of very high speed 1Mb, 2Mb, and 4Mb designs to more than 190 million units.

MOS ROM--Forecast

Long-Term Forecast

The new high-speed office systems and portable data storage applications will continue to drive the very high density ROM product growth through 1993. The very large 8Mb and 16Mb ROMs that are currently in low volume and sampling stages are expected to be major contributors to growth in 1992 and 1993. The high-speed, sub-150ns, high-density ROMs will open new markets, driven by new applications during the 1990s. Although there is a flurry of discussion and activity by current and potential U.S. suppliers regarding support of 1Mb and above devices to satisfy U.S. user demand for high-density, high-speed ROMs, ROM market dominance is not expected to shift away from the Japanese suppliers. The very high speed 100ns 1Mb and 4Mb ROM market could become a very profitable niche for the quick-to-market U.S. based supplier during the next four years. However, the Japanese suppliers have been producing the 1Mb device since 1984 and the 4Mb device since 1985. If these devices follow the typical life cycle and learning curve trends for products, the 1Mb device has already peaked (in 1988), and the 4Mb product will peak by 1991. Although shortages and demand in 1988 and 1989 have raised these product prices substantially, an expected slowdown in 1990 could dampen the profit margins of a newly ramping ROM producer. Currently, six U.S., two Taiwanese, two Korean, and one European semiconductor manufacturers are interested in pursuing high-density ROM production. By being positioned onshore, a U.S.-based supplier can offer its customers shorter turnaround time and more cost-effective products. Although ROMs will be competing with new high-density EPROM and FLASH devices, the potential for ROM growth in the United States, from U.S. office system manufacturer, could be significant.

MOS EPROM--Forecast

Dataquest's MOS EPROM data consist of revenue, unit shipments, and prices for MOS EPROM product lines. Table 1 lists the top-level market data for all of the tables. The data include all EPROM revenue, regardless of the technology employed (NMOS or CMOS) or package type (plastic or ceramic). The tables included in these data are as follows:

- Table 1—MOS EPROMs—Total Worldwide Market
- Table 2—Worldwide NMOS EPROM Market—Total (UV and OTP)
- Table 3—Worldwide CMOS EPROM Market—Total (UV and OTP)
- Table 4—Worldwide MOS UV EPROM Market—Total (NMOS and CMOS)
- Table 5—Worldwide NMOS UV EPROM Market
- Table 6—Worldwide CMOS UV EPROM Market
- Table 7—Worldwide MOS OTP EPROM Market—Total (NMOS and CMOS)
- Table 8—Worldwide NMOS OTP EPROM Market
- Table 9—Worldwide CMOS OTP EPROM Market

MOS EPROM—Forecast

Table 1

MOS EPROMs—Total Worldwide Market

	Millions of Dollars							
	1986	1987	1988	1989	1990	1991	1992	1993
4K	0	0	0	0	0	0	0	0
8K	0	0	0	0	0	0	0	0
16K	\$ 35	\$ 27	\$ 33	\$ 31	\$ 28	\$ 28	\$ 26	\$ 26
32K	48	46	50	45	40	36	34	31
64K	266	227	254	247	220	216	172	122
128K	163	201	254	239	194	121	103	89
256K	320	548	634	592	512	439	418	393
512K	68	254	449	496	395	317	255	216
1Mb	12	46	176	521	741	757	651	554
2Mb	0	0	0	11	25	119	445	648
4Mb	0	0	18	77	182	536	802	1,096
8Mb	0	0	0	0	0	0	5	136
Total	\$913	\$1,350	\$1,868	\$2,258	\$2,338	\$2,569	\$2,911	\$3,312
% Change from Previous Year	4%	48%	38%	21%	4%	10%	13%	14%

	Millions of Units							
	1986	1987	1988	1989	1990	1991	1992	1993
4K	0	0	0	0	0	0	0	0
8K	0	0	0	0	0	0	0	0
16K	14.7	9.7	8.6	7.8	7.0	6.8	6.4	6.2
32K	21.6	16.2	13.9	11.6	10.0	8.8	8.0	7.3
64K	99.6	75.7	65.3	61.0	54.0	52.0	40.0	28.0
128K	57.3	57.6	61.9	58.0	47.0	28.8	23.6	20.1
256K	70.0	118.4	130.8	130.0	122.0	102.0	95.0	86.0
512K	5.7	30.9	60.9	78.0	77.5	69.0	54.0	45.0
1Mb	0.2	1.7	9.0	37.2	68.0	88.0	87.8	85.0
2Mb	0	0	0	0.3	1.4	10.0	50.0	82.0
4Mb	0	0	0.2	1.7	7.0	36.0	81.0	126.0
8Mb	0	0	0	0	0	0	0.1	4.0
Total	269.1	310.1	350.7	385.6	393.9	401.4	445.9	489.6
% Change from Previous Year	10%	15%	13%	10%	2%	2%	11%	10%

(Continued)

MOS EPROM--Forecast

Table 1 (Continued)

MOS EPROMs--Total Worldwide Market

	Average Selling Price (\$)							
	1986	1987	1988	1989	1990	1991	1992	1993
4K	0	0	0	0	0	0	0	0
8K	0	0	0	0	0	0	0	0
16K	\$ 2.40	\$ 2.80	\$ 3.88	\$ 4.00	\$ 4.00	\$ 4.07	\$ 4.10	\$ 4.20
32K	\$ 2.24	\$ 2.83	\$ 3.57	\$ 3.88	\$ 4.04	\$ 4.10	\$ 4.20	\$ 4.25
64K	\$ 2.67	\$ 3.00	\$ 3.89	\$ 4.05	\$ 4.08	\$ 4.15	\$ 4.30	\$ 4.35
128K	\$ 2.85	\$ 3.50	\$ 4.10	\$ 4.12	\$ 4.12	\$ 4.20	\$ 4.35	\$ 4.45
256K	\$ 4.57	\$ 4.63	\$ 4.85	\$ 4.55	\$ 4.20	\$ 4.30	\$ 4.40	\$ 4.57
512K	\$11.96	\$ 8.23	\$ 7.36	\$ 6.36	\$ 5.10	\$ 4.60	\$ 4.72	\$ 4.80
1Mb	\$56.87	\$27.54	\$19.51	\$14.00	\$10.90	\$ 8.60	\$ 7.42	\$ 6.52
2Mb	0	0	0	\$35.00	\$18.00	\$11.90	\$ 8.90	\$ 7.90
4Mb	0	0	\$80.00	\$45.00	\$26.00	\$14.90	\$ 9.90	\$ 8.70
8Mb	0	0	0	0	0	\$90.00	\$50.00	\$34.00
Overall ASP	\$ 3.39	\$ 4.35	\$ 5.33	\$ 5.85	\$ 5.94	\$ 6.40	\$ 6.53	\$ 6.76
% Change from Previous Year	(5%)	28%	22%	10%	1%	8%	2%	4%

Source: Dataquest
August 1989

MOS EPROM--Forecast

Table 2

Worldwide NMOS EPROM Market--Total (UV and OTP)

	<u>Millions of Dollars</u>							
	<u>1986</u>	<u>1987</u>	<u>1988</u>	<u>1989</u>	<u>1990</u>	<u>1991</u>	<u>1992</u>	<u>1993</u>
4K	0	0	0	0	0	0	0	0
8K	0	0	0	0	0	0	0	0
16K	\$ 35	\$ 19	\$ 18	\$ 12	\$ 11	\$ 9	\$ 8	\$ 7
32K	44	36	42	34	26	23	21	18
64K	206	143	145	90	57	45	36	23
128K	152	157	174	144	107	58	43	33
256K	237	312	262	163	116	80	81	52
512K	63	179	279	236	138	87	50	29
1Mb	3	8	28	94	56	25	15	11
2Mb	0	0	0	0	0	0	0	0
4Mb	0	0	0	0	0	0	0	0
8Mb	0	0	0	0	0	0	0	0
Total	\$740	\$854	\$949	\$773	\$510	\$327	\$253	\$173
% Change from Previous Year	(6%)	15%	11%	(18%)	(34%)	(36%)	(23%)	(31%)

	<u>Millions of Units</u>							
	<u>1986</u>	<u>1987</u>	<u>1988</u>	<u>1989</u>	<u>1990</u>	<u>1991</u>	<u>1992</u>	<u>1993</u>
4K	0	0	0	0	0	0	0	0
8K	0	0	0	0	0	0	0	0
16K	14.7	7.3	5.6	3.5	2.9	2.4	1.9	1.7
32K	18.9	13.1	11.9	9.3	7.0	5.8	5.0	4.3
64K	82.5	48.5	38.3	24.0	15.0	11.5	8.5	5.4
128K	55.4	46.3	44.1	36.1	26.8	14.1	10.1	7.6
256K	53.8	71.6	58.0	38.0	28.0	19.0	18.8	11.5
512K	5.4	22.2	39.2	37.5	27.5	19.4	11.0	6.0
1Mb	0.1	0.3	1.3	5.2	5.0	2.8	2.0	1.7
2Mb	0	0	0	0	0	0	0	0
4Mb	0	0	0	0	0	0	0	0
8Mb	0	0	0	0	0	0	0	0
Total	230.9	209.3	198.3	153.6	112.2	75.0	57.3	38.2
% Change From Previous Year	3%	(9%)	(5%)	(23%)	(27%)	(33%)	(24%)	(33%)

(Continued)

MOS EPROM--Forecast

Table 2 (Continued)

Worldwide NMOS EPROM Market--Total (UV and OTP)

	Average Selling Price (\$)							
	1986	1987	1988	1989	1990	1991	1992	1993
4K	0	0	0	0	0	0	0	0
8K	0	0	0	0	0	0	0	0
16K	\$ 2.40	\$ 2.62	\$ 3.22	\$ 3.55	\$ 3.60	\$3.80	\$4.05	\$4.20
32K	\$ 2.32	\$ 2.77	\$ 3.53	\$ 3.65	\$ 3.75	\$3.90	\$4.15	\$4.25
64K	\$ 2.49	\$ 2.95	\$ 3.80	\$ 3.75	\$ 3.80	\$3.95	\$4.20	\$4.30
128K	\$ 2.75	\$ 3.38	\$ 3.95	\$ 4.00	\$ 4.00	\$4.10	\$4.25	\$4.40
256K	\$ 4.40	\$ 4.36	\$ 4.52	\$ 4.30	\$ 4.14	\$4.20	\$4.30	\$4.48
512K	\$11.73	\$ 8.06	\$ 7.12	\$ 6.28	\$ 5.00	\$4.50	\$4.54	\$4.75
1Mb	\$48.50	\$24.32	\$22.06	\$18.00	\$11.20	\$8.80	\$7.40	\$6.55
2Mb	0	0	0	0	0	0	0	0
4Mb	0	0	0	0	0	0	0	0
8Mb	0	0	0	0	0	0	0	0
Overall ASP	\$ 3.21	\$ 4.08	\$ 4.78	\$ 5.03	\$ 4.55	\$4.36	\$4.41	\$4.53
% Change from Previous Year	(7%)	27%	17%	5%	(10%)	(4%)	1%	3%

Source: Dataquest
August 1989

MOS EPROM--Forecast

Table 3

Worldwide CMOS EPROM Market--Total (UV and OTP)

	Millions of Dollars							
	1986	1987	1988	1989	1990	1991	1992	1993
4K	0	0	0	0	0	0	0	0
8K	0	0	0	0	0	0	0	0
16K	0	\$ 8	\$ 16	\$ 19	\$ 17	\$ 18	\$ 19	\$ 19
32K	\$ 7	10	8	9	13	13	13	13
64K	65	84	109	152	168	172	135	98
128K	7	45	80	96	84	62	59	56
256K	80	236	372	415	400	359	337	340
512K	4	75	170	258	265	231	204	189
1Mb	9	38	148	448	674	733	639	543
2Mb	0	0	0	11	25	119	445	648
4Mb	0	0	18	77	182	536	802	1,096
8Mb	0	0	0	0	0	0	5	136
Total	\$173	\$496	\$920	\$1,485	\$1,827	\$2,243	\$2,658	\$3,138
% Change from Previous Year	60%	187%	85%	61%	23%	23%	19%	18%

	Millions of Units							
	1986	1987	1988	1989	1990	1991	1992	1993
4K	0	0	0	0	0	0	0	0
8K	0	0	0	0	0	0	0	0
16K	0	2.4	3.1	4.3	4.1	4.4	4.5	4.5
32K	2.7	3.1	2.0	2.3	3.0	3.0	3.0	3.0
64K	17.1	27.2	27.0	37.0	39.0	40.5	31.5	22.6
128K	1.9	11.2	17.8	21.9	20.2	14.7	13.5	12.5
256K	16.2	46.9	72.8	92.0	94.0	83.0	76.2	74.5
512K	0.3	8.7	21.7	40.5	50.0	49.6	43.0	39.0
1Mb	0.1	1.4	7.8	32.0	63.0	85.2	85.8	83.3
2Mb	0	0	0	0.3	1.4	10.0	50.0	82.0
4Mb	0	0	0.2	1.7	7.0	36.0	81.0	126.0
8Mb	0	0	0	0	0	0	0.1	4.0
Total	38.3	100.8	152.4	232.0	281.7	326.4	388.6	451.4
% Change from Previous Year	82%	163%	51%	52%	21%	16%	19%	16%

(Continued)

MOS EPROM--Forecast

Table 3 (Continued)

Worldwide CMOS EPROM Market--Total (UV and OTP)

	Average Selling Price (\$)							
	1986	1987	1988	1989	1990	1991	1992	1993
4K	0	0	0	0	0	0	0	0
8K	0	0	0	0	0	0	0	0
16K	0	\$ 3.36	\$ 5.08	\$ 4.50	\$ 4.20	\$ 4.10	\$ 4.20	\$ 4.20
32K	\$ 2.71	\$ 3.08	\$ 3.81	\$ 3.90	\$ 4.30	\$ 4.20	\$ 4.20	\$ 4.25
64K	\$ 3.80	\$ 3.08	\$ 4.02	\$ 4.10	\$ 4.30	\$ 4.25	\$ 4.30	\$ 4.35
128K	\$ 3.89	\$ 4.00	\$ 4.47	\$ 4.40	\$ 4.15	\$ 4.25	\$ 4.38	\$ 4.45
256K	\$ 4.93	\$ 5.04	\$ 5.11	\$ 4.51	\$ 4.25	\$ 4.32	\$ 4.42	\$ 4.57
512K	\$13.95	\$ 8.69	\$ 7.80	\$ 6.38	\$ 5.30	\$ 4.65	\$ 4.75	\$ 4.85
1Mb	\$62.62	\$28.27	\$19.09	\$14.00	\$10.70	\$ 8.60	\$ 7.45	\$ 6.52
2Mb	0	0	0	\$35.00	\$18.00	\$11.90	\$ 8.90	\$ 7.90
4Mb	0	0	\$80.00	\$45.00	\$26.00	\$14.90	\$ 9.90	\$ 8.70
8Mb	0	0	0	0	0	\$90.00	\$50.00	\$34.00
Overall ASP	\$ 4.52	\$ 4.92	\$ 6.03	\$ 6.40	\$ 6.49	\$ 6.87	\$ 6.84	\$ 6.95
% Change from Previous Year		9%	23%	6%	1%	6%	0	2%

Source: Dataquest
August 1989

MOS EPROM--Forecast

Table 4

Worldwide MOS UV EPROM Market--Total (NMOS and CMOS)

	Millions of Dollars							
	1986	1987	1988	1989	1990	1991	1992	1993
4K	0	0	0	0	0	0	0	0
8K	0	0	0	0	0	0	0	0
16K	\$ 35	\$ 27	\$ 33	\$ 32	\$ 28	\$ 27	\$ 27	\$ 26
32K	46	46	50	43	39	35	33	31
64K	256	174	232	228	213	215	173	125
128K	150	182	234	229	186	119	103	91
256K	272	478	574	536	494	425	412	387
512K	68	246	414	409	333	265	204	181
1Mb	12	46	171	507	632	605	485	458
2Mb	0	0	0	11	24	86	389	546
4Mb	0	0	18	77	163	486	721	896
8Mb	0	0	0	0	0	0	5	136
Total	\$840	\$1,199	\$1,726	\$2,070	\$2,111	\$2,264	\$2,552	\$2,877
% Change from Previous Year	(5%)	43%	44%	20%	2%	7%	13%	13%

	Millions of Units							
	1986	1987	1988	1989	1990	1991	1992	1993
4K	0	0	0	0	0	0	0	0
8K	0	0	0	0	0	0	0	0
16K	14.7	9.7	8.6	7.8	7.0	6.8	6.4	6.2
32K	20.7	16.2	13.9	11.6	10.0	8.8	8.0	7.3
64K	93.9	56.3	58.8	56.1	51.0	50.4	39.5	28.0
128K	52.2	50.3	55.8	53.9	44.6	27.8	23.4	20.1
256K	57.5	100.8	115.3	117.0	112.7	95.1	89.3	81.5
512K	5.7	29.0	55.0	63.0	61.8	55.0	41.9	34.5
1Mb	0.2	1.7	8.7	34.2	57.0	68.0	63.8	61.5
2Mb	0	0	0	0.3	1.3	7.0	42.0	65.0
4Mb	0	0	0.2	1.7	6.2	32.0	70.0	106.0
8Mb	0	0	0	0	0	0	0.1	4.0
Total	244.8	264.1	316.3	345.6	351.6	350.9	384.4	414.1
% Change from Previous Year	0	8%	20%	9%	2%	0	10%	8%

(Continued)

MOS EPROM--Forecast

Table 4 (Continued)

Worldwide MOS UV EPROM Market--Total (NMOS and CMOS)

	Average Selling Price (\$)							
	1986	1987	1988	1989	1990	1991	1992	1993
4K	0	0	0	0	0	0	0	0
8K	0	0	0	0	0	0	0	0
16K	\$ 2.40	\$ 2.80	\$ 3.88	\$ 4.07	\$ 3.95	\$ 3.99	\$ 4.16	\$ 4.20
32K	\$ 2.24	\$ 2.83	\$ 3.57	\$ 3.70	\$ 3.92	\$ 4.00	\$ 4.17	\$ 4.25
64K	\$ 2.73	\$ 3.08	\$ 3.95	\$ 4.06	\$ 4.18	\$ 4.26	\$ 4.37	\$ 4.46
128K	\$ 2.88	\$ 3.62	\$ 4.20	\$ 4.24	\$ 4.17	\$ 4.28	\$ 4.40	\$ 4.53
256K	\$ 4.73	\$ 4.74	\$ 4.98	\$ 4.58	\$ 4.38	\$ 4.47	\$ 4.62	\$ 4.75
512K	\$11.94	\$ 8.49	\$ 7.52	\$ 6.49	\$ 5.39	\$ 4.82	\$ 4.87	\$ 5.25
1Mb	\$58.57	\$27.53	\$19.63	\$14.82	\$11.09	\$ 8.90	\$ 7.60	\$ 7.45
2Mb	0	0	0	\$35.00	\$18.45	\$12.25	\$ 9.26	\$ 8.40
4Mb	0	0	0	\$45.00	\$26.25	\$15.20	\$10.30	\$ 8.45
8Mb	0	0	0	0	0	\$90.00	\$50.00	\$34.00
Overall ASP	\$ 3.43	\$ 4.54	\$ 5.46	\$ 5.99	\$ 6.01	\$ 6.45	\$ 6.64	\$ 6.95
% Change from Previous Year	(5%)	32%	20%	10%	0	7%	3%	5%

Source: Dataquest
August 1989

MOS EPROM--Forecast

Table 5
Worldwide NMOS UV EPROM Market

	Millions of Dollars							
	1986	1987	1988	1989	1990	1991	1992	1993
4K	0	0	0	0	0	0	0	0
8K	0	0	0	0	0	0	0	0
16K	\$ 35	\$ 19	\$ 18	\$ 12	\$ 10	\$ 9	\$ 8	\$ 7
32K	39	36	42	34	26	23	21	18
64K	193	122	135	85	54	44	36	23
128K	143	137	161	139	104	57	43	34
256K	202	252	239	149	106	74	62	48
512K	63	172	249	175	106	66	35	16
1Mb	3	8	28	94	56	25	15	12
2Mb	0	0	0	0	0	0	0	0
4Mb	0	0	0	0	0	0	0	0
8Mb	0	0	0	0	0	0	0	0
Total	\$679	\$745	\$872	\$688	\$462	\$297	\$220	\$158
% Change from Previous Year	(13%)	10%	17%	(21%)	(33%)	(36%)	(26%)	(28%)

	Millions of Units							
	1986	1987	1988	1989	1990	1991	1992	1993
4K	0	0	0	0	0	0	0	0
8K	0	0	0	0	0	0	0	0
16K	14.7	7.3	5.6	3.5	2.9	2.4	1.9	1.7
32K	18.1	13.1	11.9	9.3	7.0	5.8	5.0	4.3
64K	77.6	40.6	35.1	22.1	14.0	11.1	8.5	5.4
128K	50.3	39.5	39.7	33.8	25.6	13.7	10.1	7.6
256K	43.4	56.9	51.7	33.9	25.0	16.9	14.0	10.5
512K	5.4	20.4	34.3	27.5	20.5	14.4	7.4	3.0
1Mb	0.1	0.3	1.3	5.2	5.0	2.8	2.0	1.7
2Mb	0	0	0	0	0	0	0	0
4Mb	0	0	0	0	0	0	0	0
8Mb	0	0	0	0	0	0	0	0
Total	209.5	178.1	179.5	135.3	100.0	67.1	48.9	34.2
% Change from Previous Year	(7%)	(15%)	1%	(25%)	(26%)	(33%)	(27%)	(30%)

(Continued)

MOS EPROM--Forecast

Table 5 (Continued)

Worldwide NMOS UV EPROM Market

	Average Selling Price (\$)							
	1986	1987	1988	1989	1990	1991	1992	1993
4K	0	0	0	0	0	0	0	0
8K	0	0	0	0	0	0	0	0
16K	\$ 2.40	\$ 2.62	\$ 3.22	\$ 3.55	\$ 3.60	\$3.80	\$4.05	\$4.20
32K	\$ 2.17	\$ 2.77	\$ 3.53	\$ 3.65	\$ 3.75	\$3.90	\$4.15	\$4.25
64K	\$ 2.49	\$ 3.00	\$ 3.85	\$ 3.85	\$ 3.85	\$3.95	\$4.20	\$4.30
128K	\$ 2.84	\$ 3.48	\$ 4.06	\$ 4.12	\$ 4.05	\$4.15	\$4.30	\$4.45
256K	\$ 4.65	\$ 4.42	\$ 4.62	\$ 4.40	\$ 4.25	\$4.35	\$4.45	\$4.55
512K	\$11.82	\$ 8.40	\$ 7.26	\$ 6.35	\$ 5.15	\$4.60	\$4.75	\$5.20
1Mb	\$48.50	\$24.32	\$22.06	\$18.00	\$11.20	\$8.80	\$7.45	\$7.30
2Mb	0	0	0	0	0	0	0	0
4Mb	0	0	0	0	0	0	0	0
8Mb	0	0	0	0	0	0	0	0
Overall ASP	\$ 3.24	\$ 4.18	\$ 4.86	\$ 5.09	\$ 4.62	\$4.42	\$4.50	\$4.63
% Change from Previous Year	(7%)	(29%)	16%	5%	(9%)	(4%)	2%	3%

Source: Dataquest
August 1989

MOS EPROM--Forecast

Table 6

Worldwide CMOS UV EPROM Market

	Millions of Dollars							
	1986	1987	1988	1989	1990	1991	1992	1993
4K	0	0	0	0	0	0	0	0
8K	0	0	0	0	0	0	0	0
16K	0	\$ 8	\$ 16	\$ 19	\$ 17	\$ 18	\$ 19	\$ 19
32K	\$ 7	10	8	9	13	13	13	13
64K	63	52	97	143	159	171	137	102
128K	7	45	73	89	82	62	60	57
256K	70	226	335	386	388	352	350	339
512K	4	75	164	234	228	199	169	165
1Mb	9	38	143	413	576	580	470	446
2Mb	0	0	0	11	24	86	389	546
4Mb	0	0	18	77	163	486	721	896
8Mb	0	0	0	0	0	0	5	136
Total	\$161	\$454	\$855	\$1,382	\$1,649	\$1,967	\$2,332	\$2,719
% Change from Previous Year	54%	181%	88%	62%	19%	19%	19%	17%

	Millions of Units							
	1986	1987	1988	1989	1990	1991	1992	1993
4K	0	0	0	0	0	0	0	0
8K	0	0	0	0	0	0	0	0
16K	0	2.4	3.1	4.3	4.1	4.4	4.5	4.5
32K	2.7	3.1	2.0	2.3	3.0	3.0	3.0	3.0
64K	16.3	15.8	23.7	34.0	37.0	39.3	31.0	22.6
128K	1.9	10.8	16.1	20.1	19.0	14.1	13.3	12.5
256K	14.1	43.9	63.6	83.1	87.7	78.2	75.3	71.0
512K	0.3	8.6	20.7	35.5	41.3	40.6	34.5	31.5
1Mb	0.1	1.4	7.5	29.0	52.0	65.2	61.8	59.8
2Mb	0	0	0	0.3	1.3	7.0	42.0	65.0
4Mb	0	0	0.2	1.7	6.2	32.0	70.0	106.0
8Mb	0	0	0	0	0	0	0.1	4.0
Total	35.3	86.0	136.8	210.3	251.6	283.8	335.5	379.9
% Change from Previous Year	76%	143%	59%	54%	20%	13%	18%	13%

(Continued)

MOS EPROM--Forecast

Table 6 (Continued)

Worldwide CMOS UV EPROM Market

	Average Selling Price (\$)							
	1986	1987	1988	1989	1990	1991	1992	1993
4K	0	0	0	0	0	0	0	0
8K	0	0	0	0	0	0	0	0
16K	0	\$ 3.36	\$ 5.08	\$ 4.50	\$ 4.20	\$ 4.10	\$ 4.20	\$ 4.20
32K	\$ 2.71	\$ 3.08	\$ 3.81	\$ 3.90	\$ 4.30	\$ 4.20	\$ 4.20	\$ 4.25
64K	\$ 3.87	\$ 3.30	\$ 4.10	\$ 4.20	\$ 4.30	\$ 4.35	\$ 4.42	\$ 4.50
128K	\$ 3.94	\$ 4.15	\$ 4.55	\$ 4.45	\$ 4.32	\$ 4.40	\$ 4.48	\$ 4.58
256K	\$ 4.98	\$ 5.15	\$ 5.27	\$ 4.65	\$ 4.42	\$ 4.50	\$ 4.65	\$ 4.78
512K	\$14.08	\$ 8.69	\$ 7.95	\$ 6.60	\$ 5.51	\$ 4.90	\$ 4.90	\$ 5.25
1Mb	\$62.62	\$28.27	\$19.21	\$14.25	\$11.08	\$ 8.90	\$ 7.60	\$ 7.45
2Mb	0	0	0	\$35.00	\$18.45	\$12.25	\$ 9.26	\$ 8.40
4Mb	0	0	\$80.00	\$45.00	\$26.25	\$15.20	\$10.30	\$ 8.45
8Mb	0	0	0	0	0	\$90.00	\$50.00	\$34.00
Overall ASP	\$ 4.57	\$ 5.28	\$ 6.25	\$ 6.57	\$ 6.56	\$ 6.93	\$ 6.95	\$ 7.16
% Change from Previous Year	(12%)	16%	18%	5%	0	6%	0	3%

Source: Dataquest
August 1989

MOS EPROM--Forecast

Table 7

Worldwide MOS OTP EPROM Market--Total (NMOS and CMOS)

	Millions of Dollars							
	1986	1987	1988	1989	1990	1991	1992	1993
4K	0	0	0	0	0	0	0	0
8K	0	0	0	0	0	0	0	0
16K	0	0	0	0	0	0	0	0
32K	\$ 1	0	0	0	0	0	0	0
64K	12	\$ 51	\$ 21	\$ 16	\$ 10	\$ 5	\$ 2	0
128K	12	21	20	14	8	3	1	0
256K	46	65	61	47	32	24	21	\$ 17
512K	0	14	35	78	65	54	47	44
1Mb	0	0	5	34	94	141	144	123
2Mb	0	0	0	0	1	29	58	111
4Mb	0	0	0	0	17	48	87	140
Total	\$72	\$151	\$142	\$188	\$227	\$305	\$359	\$435
% Change from Previous Year	259%	111%	(6%)	32%	20%	35%	18%	21%

	Millions of Units							
	1986	1987	1988	1989	1990	1991	1992	1993
4K	0	0	0	0	0	0	0	0
8K	0	0	0	0	0	0	0	0
16K	0	0	0	0	0	0	0	0
32K	0.9	0	0	0	0	0	0	0
64K	5.7	19.3	6.5	4.9	3.0	1.6	0.5	0
128K	5.2	7.2	6.2	4.1	2.4	1.0	0.2	0
256K	12.5	17.6	15.5	13.0	9.3	6.9	5.7	4.5
512K	0	1.8	6.0	15.0	15.7	14.0	12.1	10.5
1Mb	0	0	0.3	3.0	11.0	20.0	24.0	23.5
2Mb	0	0	0	0	0.1	3.0	8.0	17.0
4Mb	0	0	0	0	0.8	4.0	11.0	20.0
Total	24.2	46.0	34.5	40.0	42.3	50.5	61.5	75.5
% Change from Previous Year	192%	90%	(25%)	16%	6%	19%	22%	23%

(Continued)

MOS EPROM--Forecast

Table 7 (Continued)

Worldwide MOS OTP EPROM Market--Total (NMOS and CMOS)

	Average Selling Price (\$)							
	1986	1987	1988	1989	1990	1991	1992	1993
4K	0	0	0	0	0	0	0	0
8K	0	0	0	0	0	0	0	0
16K	0	0	0	0	0	0	0	0
32K	\$ 1.75	0	0	0	0	0	0	0
64K	\$ 2.01	\$2.64	\$ 3.17	\$ 3.22	\$ 3.23	\$ 3.39	\$3.49	0
128K	\$ 2.27	\$2.92	\$ 3.31	\$ 3.38	\$ 3.32	\$ 3.40	\$3.52	0
256K	\$ 3.73	\$3.67	\$ 3.96	\$ 3.64	\$ 3.43	\$ 3.51	\$3.64	\$3.78
512K	\$10.19	\$7.56	\$ 5.89	\$ 5.17	\$ 4.13	\$ 3.83	\$3.89	\$4.18
1Mb	0	0	\$15.30	\$11.22	\$ 8.56	\$ 7.05	\$6.00	\$5.25
2Mb	0	0	0	0	\$14.50	\$ 9.70	\$7.25	\$6.55
4Mb	0	0	0	0	\$20.80	\$12.10	\$7.88	\$6.99
Overall ASP	\$ 2.95	\$3.27	\$ 4.13	\$ 4.71	\$ 5.36	\$ 6.04	\$5.84	\$5.77

Source: Dataquest
August 1989

MOS EPROM--Forecast

Table 8

Worldwide NMOS OTP EPROM Market

	Millions of Dollars							
	1986	1987	1988	1989	1990	1991	1992	1993
4K	0	0	0	0	0	0	0	0
8K	0	0	0	0	0	0	0	0
16K	0	0	0	0	0	0	0	0
32K	\$ 1	0	0	0	0	0	0	0
64K	10	\$ 19	\$10	\$ 6	\$ 3	\$ 1	0	0
128K	12	20	14	8	4	1	0	0
256K	38	52	23	14	10	7	\$ 5	\$ 4
512K	0	13	28	52	28	19	14	12
1Mb	0	0	0	0	0	0	0	0
2Mb	0	0	0	0	0	0	0	0
4Mb	0	0	0	0	0	0	0	0
Total	\$61	\$105	\$76	\$80	\$45	\$29	\$19	\$16

% Change from Previous Year	266%	72%	(28)	5	(44)	(36)	(32)	(19)
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	Millions of Units							
	1986	1987	1988	1989	1990	1991	1992	1993
4K	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
8K	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
16K	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
32K	0.9	N/A	N/A	N/A	N/A	N/A	N/A	N/A
64K	4.9	7.9	3.2	1.9	1.0	0.4	0	0
128K	5.2	6.8	4.5	2.3	1.2	0.4	0	0
256K	10.4	14.7	6.3	4.1	3.0	2.1	1.5	1.0
512K	0	1.8	4.9	10.0	7.0	5.0	3.6	3.0
1Mb	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2Mb	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
4Mb	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total	21.4	31.2	18.8	18.3	12.2	7.9	5.1	4.0

(Continued)

MOS EPROM--Forecast

Table 8 (Continued)

Worldwide NMOS OTP EPROM Market

	Average Selling Price (\$)							
	1986	1987	1988	1989	1990	1991	1992	1993
4K	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
8K	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
16K	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
32K	\$ 1.75	N/A	N/A	N/A	N/A	N/A	N/A	N/A
64K	\$ 1.96	\$2.42	\$3.08	\$3.10	\$2.90	\$3.22	0	0
128K	\$ 2.27	\$2.90	\$3.20	\$3.25	\$3.20	\$3.28	0	0
256K	\$ 3.63	\$3.58	\$3.68	\$3.50	\$3.40	\$3.40	\$3.60	\$3.70
512K	\$10.00	\$7.55	\$5.80	\$5.20	\$4.00	\$3.80	\$3.90	\$4.00
1Mb	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2Mb	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
4Mb	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Overall ASP	\$ 2.85	\$3.36	\$4.02	\$4.36	\$3.68	\$3.64	\$3.81	\$3.93

N/A = Not Available

Source: Dataquest
August 1989

MOS EPROM--Forecast

Table 9

Worldwide CMOS OTP EPROM Market

	Millions of Dollars							
	1986	1987	1988	1989	1990	1991	1992	1993
4K	0	0	0	0	0	0	0	0
8K	0	0	0	0	0	0	0	0
16K	0	0	0	0	0	0	0	0
32K	0	0	0	0	0	0	0	0
64K	\$ 2	\$32	\$11	\$ 10	\$ 7	\$ 4	\$ 2	0
128K	0	1	6	6	4	2	1	0
256K	9	12	38	33	22	17	15	\$ 13
512K	0	0	7	26	37	35	33	32
1Mb	0	0	5	34	94	141	144	123
2Mb	0	0	0	0	1	29	58	111
4Mb	0	0	0	0	17	48	87	140
Total	\$11	\$46	\$67	\$109	\$182	\$276	\$339	\$420
% Change from Previous Year	228%	330%	46%	63%	67%	52%	23%	24%

	Millions of Units							
	1986	1987	1988	1989	1990	1991	1992	1993
4K	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
8K	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
16K	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
32K	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
64K	0.8	11.4	3.3	3.0	2.0	1.2	0.5	0
128K	0	0.4	1.7	1.8	1.2	0.6	0.2	0
256K	2.1	3.0	9.2	8.9	6.3	4.8	4.2	3.5
512K	0	0.1	1.1	5.0	8.7	9.0	8.5	7.5
1Mb	0	0	0.3	3.0	11.0	20.0	24.0	23.5
2Mb	N/A	N/A	N/A	0	0.1	3.0	8.0	17.0
4Mb	N/A	N/A	N/A	0	0.8	4.0	11.0	20.0
Total	2.9	14.8	15.6	21.7	30.1	42.6	56.4	71.5

(Continued)

MOS EPROM--Forecast

Table 9 (Continued)

Worldwide CMOS OTP EPROM Market

	Average Selling Price (\$)							
	1986	1987	1988	1989	1990	1991	1992	1993
4K	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
8K	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
16K	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
32K	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
64K	\$ 2.35	\$2.80	\$ 3.25	\$ 3.30	\$ 3.40	\$ 3.44	\$3.49	0
128K	\$ 2.89	\$3.20	\$ 3.60	\$ 3.55	\$ 3.43	\$ 3.48	\$3.52	0
256K	\$ 4.22	\$4.10	\$ 4.15	\$ 3.71	\$ 3.45	\$ 3.56	\$3.65	\$ 3.80
512K	\$11.30	\$7.90	\$ 6.30	\$ 5.12	\$ 4.24	\$ 3.85	\$3.88	\$ 4.25
1Mb	N/A	N/A	\$15.30	\$11.22	\$ 8.56	\$ 7.05	\$6.00	\$ 5.25
2Mb	N/A	N/A	N/A	N/A	\$14.50	\$ 9.70	\$7.25	\$ 6.55
4Mb	N/A	N/A	N/A	0	\$20.80	\$12.10	\$7.88	\$ 6.99
Overall ASP	\$ 3.71	\$3.09	\$ 4.27	\$ 5.00	\$ 6.04	\$ 6.49	\$6.02	\$ 5.87

N/A = Not Available

Source: Dataquest
August 1989

MOS EPROM--Forecast

THE MARKET—1988

Worldwide MOS EPROM revenue totaled \$1.87 billion in 1988, growing 38 percent in revenue over a 1987 total of \$1.35 billion, with strong growth expected to continue through 1989. Intel maintained its lead with more than 18.0 percent unit share of the worldwide market, followed by SGS-Thomson with 12.6 percent unit share. In 1988, worldwide reported units increased to 350.7 million, 13.0 percent over the 310.1 million units shipped in 1987. Although CMOS technology continued to garner share from NMOS during 1988, the most significant changes in 1988 were product shortages and higher average selling prices (ASPs) in key EPROM densities.

COMPARISON WITH EARLIER FORECASTS

The current Dataquest EPROM forecast contains several significant differences from our July 1988 forecast. The changes and reasons for these differences are as follows:

- Actual revenue, unit shipments, and ASPs for 1987 have been adjusted to reflect final numbers that were completed by the middle of 1988.
- Actual bit shipments increased 44 percent as a result of continued strong growth in the 256K and 512K densities.
- The NMOS share of EPROMs continued to decline, representing 56.5 percent of all EPROM units shipped in 1988 (down from 67.5 percent in 1987) and 85.8 percent share of units in 1986.
- U.S. manufacturers' share of the EPROM market increased for a second consecutive year, reaching 51.3 percent, while Japanese manufacturers' share dropped to 39.6 percent and European manufacturers' share grew to 13.2 percent.
- Shipments of high-speed 16K through 1Mb CMOS devices continued to increase in 1988. As a result, Dataquest increased its unit forecasts and extended the life cycle forecasts of the 16K, 64K, and 256K EPROMs.

MARKET OUTLOOK

Although worldwide EPROM production and shipments grew 13 percent in 1988, strong demand and continued high ASPs were the greatest contributors to strong revenue growth in 1988. Although U.S. and European EPROM suppliers continued to benefit from MITI-imposed production reductions, EPROM users were forced to endure product shortages, long lead times, and very high prices in the 64K through 512K densities during the first three quarters of 1988. ASPs increased 22 percent overall in 1988,

MOS EPROM--Forecast

averaging out at \$5.33. This price is in comparison with \$4.35 in 1987. The fourth quarter of 1988 saw EPROM prices softening from the 1Mb 128Kx8 configurations, down through the 64K densities as a result of increased capacity from the U.S. and European manufacturers. As MITI continued to impose production cutback guidelines for memory suppliers in Japan, Fujitsu and Mitsubishi followed in the path of Hitachi, NEC, Oki and Toshiba, drastically slowing down and/or stopping quarter-to-quarter production of their 64K, 128K, and 256K EPROMs. These suppliers give very little indication that they will return to the low-density EPROM arena. Dataquest expects these manufacturers to redirect their focus into the extremely high-speed, high-density market during the next six quarters for a large ramp-up in production that could promote very strong nonvolatile memory growth from 1991 through 1993.

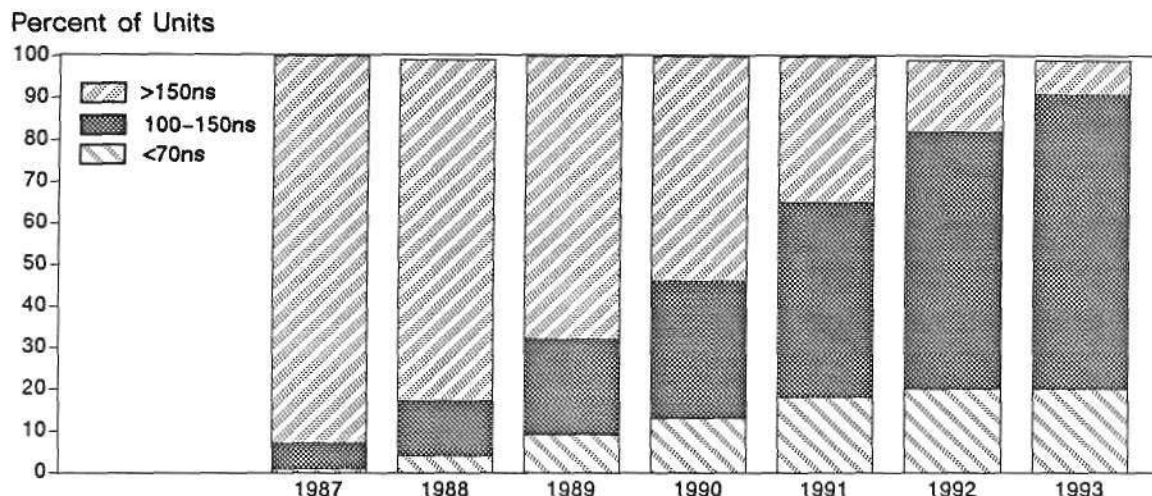
High-Speed EPROMs

Figure 1 illustrates Dataquest's estimate of the 1989 to 1993 high-speed EPROM market as a percentage of total units. The very high speed (less than 70ns) products, which now have speeds averaging 20 to 55ns, continue to be driven by the low-speed 8K, 16K, and 64K devices. These low-density, high-speed products are designed for very specific bipolar PROM replacement applications. The 55 to 100ns or high-speed arena saw many developments in the 256K through 4Mb EPROMs to accommodate high-speed developments in the 16-bit/32-bit MPUs. A few of these include 1988 ISSCC announcements of new products such as Intel's 90ns 4Mb CMOS EPROM, Hitachi's 55ns 64Kx16 device, and SGS-Thomson's 70ns 64Kx16 device. We continue to believe that the 100 to 150ns range will be the most prevalent EPROM speed range by 1992, with ramp-up in volume production beginning in the latter part of 1990. Although 64K and 256K densities sustained the largest growth for demands of high speed and very high speed in 1988, production grew in densities of 512K and more in the first quarter of 1989, and continued growth is expected through the end of the year.

MOS EPROM--Forecast

Figure 1

High-Speed EPROM Market Forecast



0004717-1

Source: Dataquest
August 1989

CMOS/NMOS EPROMs

CMOS technology represented a 51 percent share of total EPROM production in 1988, surpassing Dataquest's previous projection of a 45 percent share. As such, we expect the CMOS share to continue growing, surpassing NMOS with a more than 52 percent share of units by the end of 1989 and an expected 71 percent share of the total market by the end of 1990. The 64K and 256K devices maintained the strongest density share of the entire EPROM product lineup in 1988, with respective shares of 41 and 55 percent.

MOS UV/OTP EPROMs

Table 4 shows EPROMs packaged in UV erasable packages, while Table 7 deals strictly with production of one-time programmable (OTP) EPROMs in plastic packages without windows.

Dataquest consistently has made the packaging distinction between EPROMs in UV erasable packages and those in nonerasable plastic packages, or OTPs, for the primary reason of separately tracking an anticipated shift to less expensive packages. Our forecast for 1988 through 1993 shows that UV EPROMs will continue to have a larger share of the EPROM market. The OTP EPROM product has continued to maintain a marginal and declining share of the EPROM market. Product introduction and product

MOS EPROM--Forecast

demand continue to come from densities of 256K and more. Although OTP represented a 14.8 percent share of the EPROM market in 1987, its 1988 share dropped to 10.0 percent, with an expected 10.0 percent share of the total market by the end of 1989. We expect that AMD, Mitsubishi, Sharp, Texas Instruments, and Toshiba will continue to be the major OTP suppliers, with a predominant shift to CMOS occurring during the 1990 through 1993 time frame.

Flash Memory

Flash memory technology is a new, nonvolatile memory product area that will be covered in a separate section of Dataquest's semiconductor memories notebook. Further information on flash memory technology can be found in Dataquest's SIS newsletter, "The Bare Facts About Flash," published in June 1989.

Short-Term Forecast

Dataquest believes that the EPROM pricing softness that occurred during the first two quarters of 1989 will continue through the end of the year. The price declines currently are affecting the 64K through 1Mb densities, with the most aggressive pricing occurring at the 256K level, where prices have been quoted at less than \$2. Although 1Mb EPROM unit shipments reached 9 million in 1988 as Japanese vendors captured more than 79.4 percent of market share, up from 75.0 percent in 1987, 1Mb unit shipments fell far below our expected forecast for the second consecutive year. Although user interest in the 1Mb product is high and shipments of both x8 and x16 configurations have been strong through the first two quarters of 1989, it is questionable that 1Mb EPROMs will reach market expectations of 37 million units by the end of 1989.

LONG-TERM FORECAST

Dataquest believes that the slow bit growth that has occurred since 1987 will continue through the first half of 1990. A slow but positive upturn is expected to begin during the second half of 1990, with a rapid ramp-up in production in 1991 that will continue through 1993, as demand for 1Mb through 4Mb densities increases. Bit growth is expected to have a compound annual growth rate (CAGR) of 57.7 percent from 1988 through 1993. The automotive and electronic data processing segments continue to be the strongest drivers for bit growth in the 1991 through 1993 time frame.

Although product sampling and shipment of the 2Mb and 4Mb EPROMs has been minimal during the first half of 1989, increased shipments are expected from all participants during the second half of 1990. Although strong user demand and supplier support are expected for 2Mb EPROMs in both the x8 and x16 configurations, we believe that the 4Mb will be the next area of major growth for the EPROM sector. Table 10 lists all of the known 2Mb and 4Mb participants and their products by organization.

MOS EPROM--Forecast

Table 10

1989 2Mb/4Mb CMOS EPROM Suppliers

<u>Company</u>	<u>Fastest Speed</u>	<u>2Mb</u>		<u>4Mb</u>	
		<u>x8</u>	<u>x16</u>	<u>x8</u>	<u>x16</u>
AMD	100ns		X		
	120ns				X
Fujitsu	150ns			X	X
Intel	150ns	X	X		X
Mitsubishi	100ns	X	X		
	120ns				X
NEC	150ns	X		X	
Toshiba	150ns			X	
WaferScale	100ns				X

Source: Dataquest
August 1989

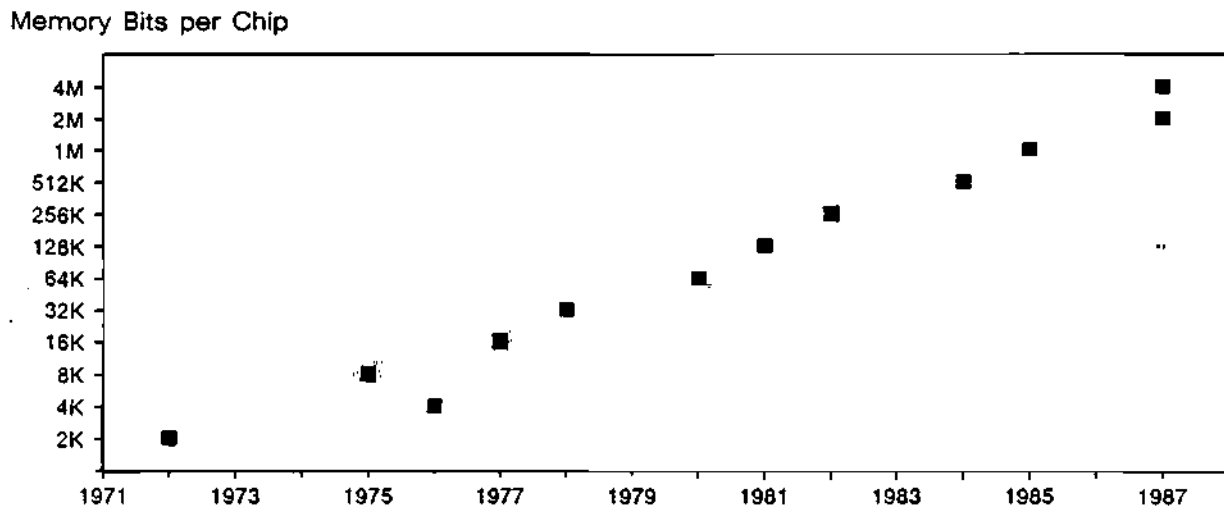
Although EPROM revenue is expected to exceed \$2.3 billion in 1990, its expected growth in units and dollars during 1989 will be marginal; 24 suppliers will be scurrying for a share of that 1990 commodity market. With densities now ranging from 16K through 4Mb and increased user demands for a variety of speeds, varying organizations, and packages, Dataquest anticipates that successful market share gains will be made only by the broad-based and/or very focused high-speed suppliers during the expected 1990 slowdown.

MOS EPROM--Forecast

SUMMARY

Intel Corporation first introduced EPROM technology in 1971. Unlike ROMs, which are permanently programmed by the manufacturer during the fabrication process, EPROMs are programmed electrically and can be repeatedly reprogrammed and erased after exposure to ultraviolet light. The EPROM, often referred to as a floating-gate memory, was invented by Dov Frohman of Intel. As shown in Figure 1, the first product out of the chute was the 2K programmed memory. The glass-windowed 1701 EPROM was introduced by Intel at the International Solid State Circuits Conference in 1971. Development of the 4K and 8K EPROMs followed in 1975, with the first one-time programmable (OTP) plastic-packaged EPROM, the 2708P, introduced by Motorola in 1977.

Figure 1
EPROM Product Development



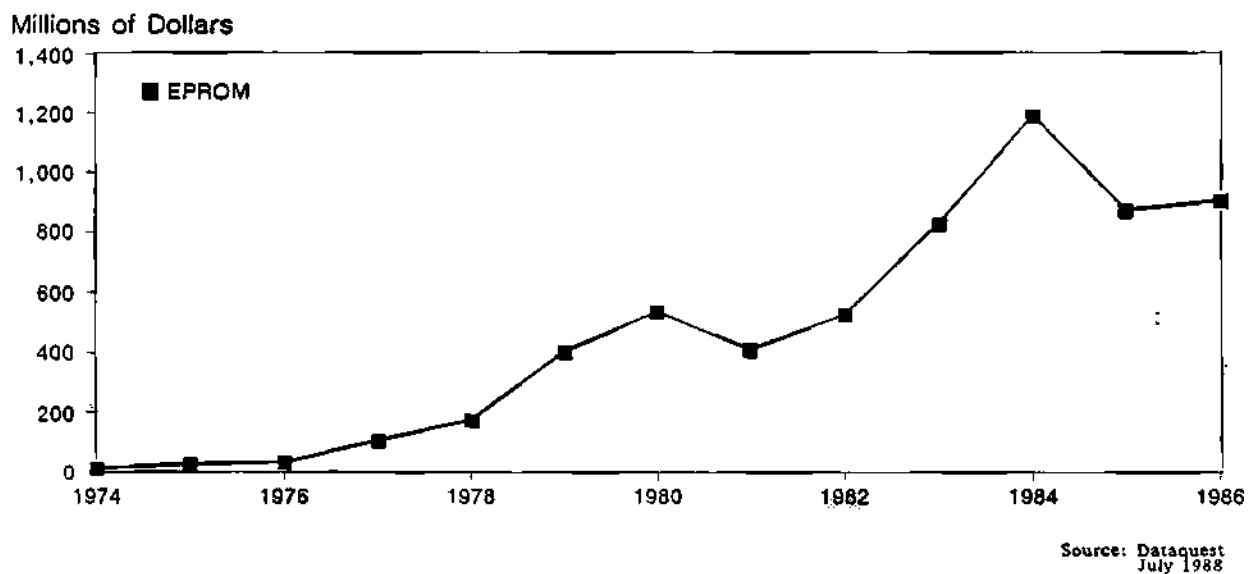
Source: Dataquest
July 1988

MOS EPROM--Forecast

The pinnacle of EPROM development was reached in 1977, with Intel's introduction of the 16K EPROM. The 5-volt 16K device was to become not only the industry standard for EPROMS, but it was also compatible with microprocessor systems. In essence, the marrying of the EPROM and the microprocessor accelerated the development of both products and the advance of the microcomputer industry.

Since 1974, the EPROM market has maintained a fairly steady rate of growth, as shown on Figure 2. Worldwide EPROM revenue grew at a 131 percent compound annual growth rate (CAGR) from 1974 to 1986.

Figure 2
EPROM Revenue Growth

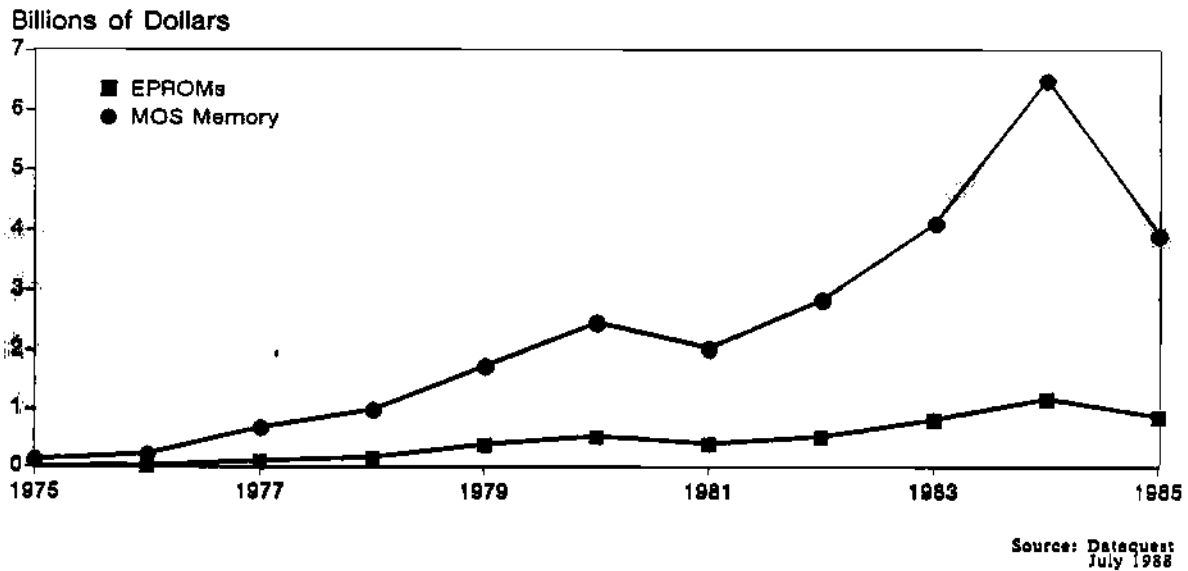


MOS EPROM--Forecast

Although the pace of the MOS memory race has intensified over the last 17 years, the EPROM segment of the memory market, as shown on Figure 3, has sustained a moderate share of the total memory market from year to year, second only to the DRAM segment. Emerging technological changes, new contenders in the market, and improved price performance, increased revenue and market share for the major EPROM suppliers through 1984. As shown on Figure 4, the market saw substantial EPROM bit growth during the 1975 to 1985 time frame.

Figure 3

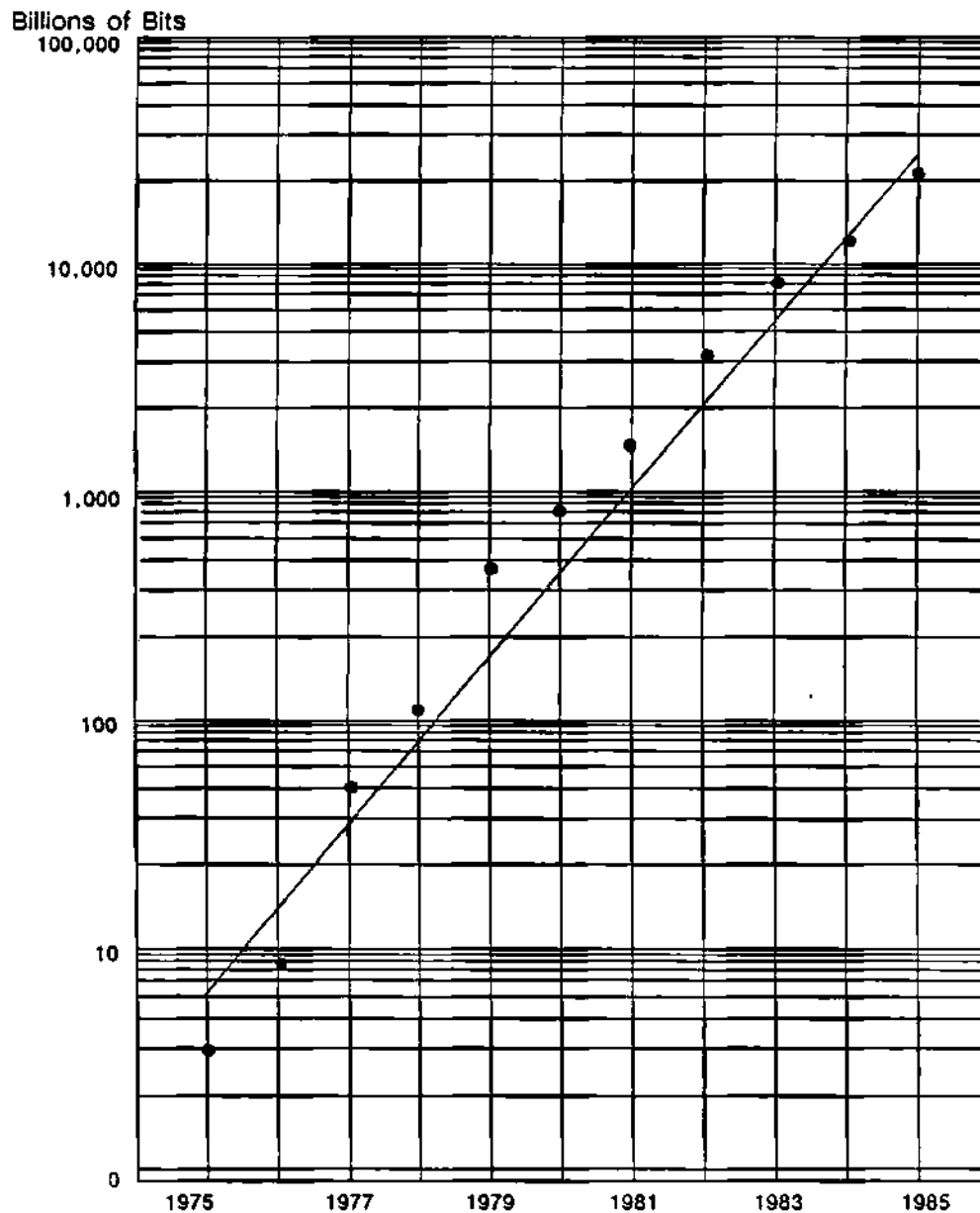
EPROM Share of MOS Memory



MOS EPROM--Forecast

Figure 4

MOS EPROM Bit Growth

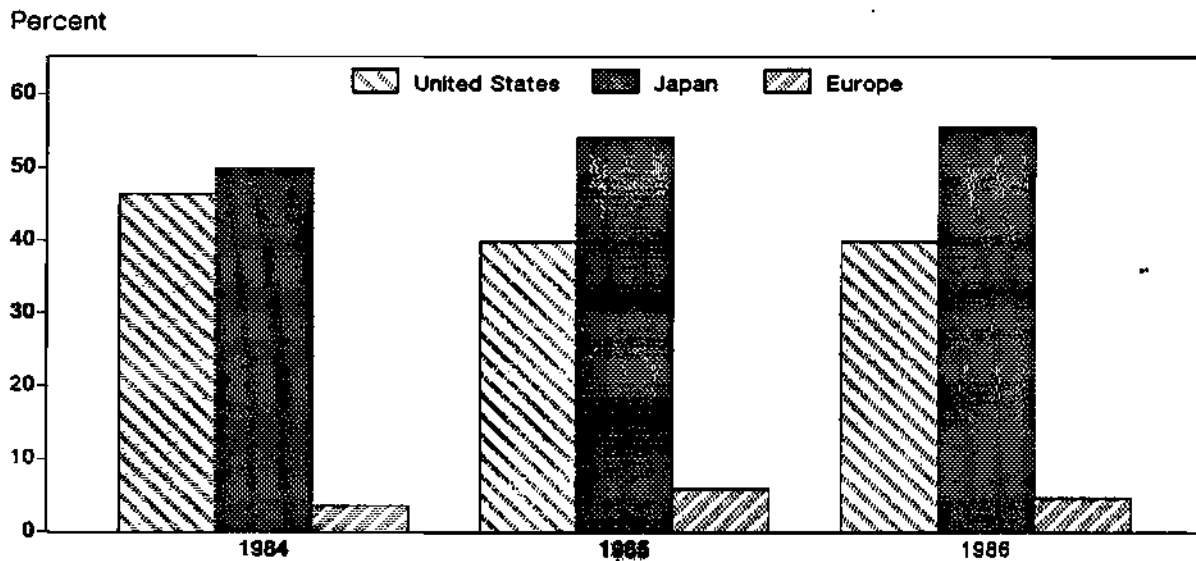


MOS EPROM--Forecast

Over the past decade, Japanese companies have made steady gains in MOS memory market share. These gains have been at the expense of U.S. semiconductor manufacturers, who have seen their market shares decrease in overall MOS memories from 74 percent in 1979 to 39 percent in 1985. The Japanese made their biggest gains in EPROM market share from 1984 through 1986, as shown on Figure 5. The yen appreciation from 1984 to 1986, aggressive pricing tactics, and new entrants to the market—including Matsushita, Seiko-Epson, and Sharp—have made the Japanese formidable contenders in the commodity EPROM market. In-depth competitive analysis is located in the SIS Memories segment notebook, behind the EPROM tab and under the "Vendor Analysis" heading. Detailed company shipment data are located in the SIS Products and Markets II notebook, and the Memories segment notebook, behind the EPROM tab under the "MOS EPROMs—Data" heading.

Figure 5

Worldwide MOS EPROM Market Share



Source: Dataquest
July 1988

MOS EPROM--Forecast

Dataquest's MOS EPROM data consist of revenue, unit shipments, and prices for MOS EPROM product lines. Table 1 lists the top-level market data for all of the tables. The data include all EPROM revenue, regardless of the technology employed (NMOS or CMOS) or package type (plastic or ceramic). The tables included in these data are as follows:

- Table 1—MOS EPROMS—Total Worldwide Market
- Table 2—Worldwide NMOS EPROM Market—Total (UV and OTP)
- Table 3—Worldwide CMOS EPROM Market—Total (UV and OTP)
- Table 4—Worldwide MOS UV EPROM Market—Total (NMOS and CMOS)
- Table 5—Worldwide NMOS UV Market
- Table 6—Worldwide CMOS UV EPROM Market
- Table 7—Worldwide MOS OTP EPROM Market—Total (NMOS and CMOS)
- Table 8—Worldwide NMOS OTP EPROM Market
- Table 9—Worldwide CMOS OTP EPROM Market

MOS EPROM--Forecast

Table 1

MOS EPROMs--Total Worldwide Market

	Millions of Dollars							
	1985	1986	1987	1988	1989	1990	1991	1992
4K	0	0	0	0	0	0	0	0
8K	0	0	0	0	0	0	0	0
16K	\$ 64	\$ 35	\$ 28	\$ 23	\$ 18	\$ 15	\$ 12	\$ 11
32K	101	48	46	35	19	10	6	3
64K	294	266	219	227	195	160	125	105
128K	226	163	201	211	191	144	116	98
256K	177	320	555	651	642	542	493	423
512K	15	68	255	372	348	330	291	245
1M	0	12	43	259	493	707	819	835
2M	0	0	0	4	25	72	253	419
4M	0	0	0	0	1	12	58	308
8M	0	0	0	0	0	0	0	5
Total	\$876	\$913	\$1,347	\$1,783	\$1,933	\$1,992	\$2,172	\$2,451
% Change from Previous Year	(26%)	4%	48%	32%	8%	3%	9%	13%

	Millions of Units							
	1985	1986	1987	1988	1989	1990	1991	1992
4K	0	0	0	0	0	0	0	0
8K	0	0	0	0	0	0	0	0
16K	24.6	14.7	9.8	6.8	4.9	3.8	3.1	2.6
32K	38.6	21.6	16.4	9.9	5.0	2.4	1.5	0.8
64K	103.0	99.6	73.2	63.0	50.0	39.0	30.0	25.0
128K	56.1	57.3	57.7	57.0	51.0	38.0	30.0	25.0
256K	22.2	70.0	119.9	140.0	137.5	126.0	116.0	102.0
512K	0.5	5.7	30.9	61.0	67.0	64.0	57.0	49.0
1M	0	0.2	1.6	16.0	44.0	79.0	107.0	121.0
2M	0	0	0	0	0.4	2.0	11.0	26.0
4M	0	0	0	0	0	0.2	1.7	15.0
8M	0	0	0	0	0	0	0	0
Total	245.0	269.1	309.5	353.8	359.8	354.4	357.3	366.4
% Change from Previous Year	11%	10%	15%	14%	2%	(2%)	1%	3%

(Continued)

MOS EPROM--Forecast

Table 1 (Continued)

MOS EPROMs--Total Worldwide Market

	Average Selling Price (\$)							
	1985	1986	1987	1988	1989	1990	1991	1992
4K	0	0	0	0	0	0	0	0
8K	0	0	0	0	0	0	0	0
16K	\$ 2.62	\$ 2.40	\$ 2.80	\$ 3.40	\$ 3.70	\$ 3.90	\$ 4.00	\$ 4.10
32K	\$ 2.61	\$ 2.24	\$ 2.83	\$ 3.50	\$ 3.80	\$ 4.00	\$ 4.10	\$ 4.15
64K	\$ 2.85	\$ 2.67	\$ 2.99	\$ 3.60	\$ 3.90	\$ 4.10	\$ 4.15	\$ 4.20
128K	\$ 4.02	\$ 2.85	\$ 3.49	\$ 3.70	\$ 3.75	\$ 3.80	\$ 3.85	\$ 3.90
256K	\$ 7.96	\$ 4.57	\$ 4.63	\$ 4.65	\$ 4.67	\$ 4.30	\$ 4.25	\$ 4.15
512K	\$ 32.44	\$11.96	\$ 8.24	\$ 6.10	\$ 5.20	\$ 5.15	\$ 5.10	\$ 5.00
1M	\$125.00	\$56.87	\$26.77	\$ 16.20	\$ 11.20	\$ 8.95	\$ 7.65	\$ 6.90
2M	0	0	0	\$110.00	\$ 62.00	\$36.00	\$23.00	\$ 16.10
4M	0	0	0	0	\$125.00	\$62.00	\$34.00	\$ 20.50
8M	0	0	0	0	0	0	0	\$135.00
Overall ASP	\$ 3.57	\$ 3.39	\$ 4.35	\$ 5.04	\$ 5.37	\$ 5.62	\$ 6.08	\$ 6.69
% Change from Previous Year	(33%)	(5%)	28%	16%	7%	5%	8%	10%

Source: Dataquest
July 1988

MOS EPROM--Forecast

Table 2

Worldwide NMOS EPROM Market--Total (UV and OTP)

	Millions of Dollars							
	1985	1986	1987	1988	1989	1990	1991	1992
4K	0	0	0	0	0	0	0	0
8K	0	0	0	0	0	0	0	0
16K	\$ 54	\$ 35	\$ 19	\$ 12	\$ 8	\$ 4	\$ 4	\$ 2
32K	82	44	37	26	14	7	4	2
64K	271	206	141	110	80	57	31	16
128K	222	152	157	144	123	83	58	42
256K	147	237	309	313	251	186	134	90
512K	14	63	177	225	174	135	91	44
1M	0	3	8	39	58	67	46	25
2M	0	0	0	0	0	0	0	0
4M	0	0	0	0	0	0	0	0
8M	0	0	0	0	0	0	0	0
Total	\$791	\$740	\$847	\$868	\$707	\$540	\$368	\$221
% Change from Previous Year		(6%)	14%	3%	(19%)	(24%)	(32%)	(40%)

	Millions of Units							
	1985	1986	1987	1988	1989	1990	1991	1992
4K	0	0	0	0	0	0	0	0
8K	0	0	0	0	0	0	0	0
16K	21.6	14.7	7.4	3.5	2.2	1.1	1.0	0.6
32K	34.1	18.9	13.3	7.4	3.6	1.7	1.0	0.4
64K	97.5	82.5	47.9	31.5	21.0	14.0	7.5	3.8
128K	55.6	55.4	46.9	39.9	33.2	22.0	15.3	11.0
256K	19.0	53.8	71.9	71.4	57.8	44.1	32.5	22.4
512K	0.4	5.4	21.9	38.4	36.2	31.4	21.7	10.8
1M	0	0.1	0.3	2.4	5.3	7.9	6.4	4.8
2M	0	0	0	0	0	0	0	0
4M	0	0	0	0	0	0	0	0
8M	0	0	0	0	0	0	0	0
Total	228.2	230.9	209.6	194.6	159.2	122.2	85.3	53.8
% Change from Previous Year		1%	(9%)	(7%)	(18%)	(23%)	(30%)	(37%)

(Continued)

MOS EPROM--Forecast

Table 2 (Continued)

Worldwide NMOS EPROM Market—Total (UV and OTP)

	Average Selling Price (\$)							
	1985	1986	1987	1988	1989	1990	1991	1992
4K	0	0	0	0	0	0	0	0
8K	0	0	0	0	0	0	0	0
16K	\$ 2.50	\$ 2.40	\$ 2.62	\$ 3.38	\$ 3.58	\$ 3.78	\$ 3.90	\$ 4.05
32K	\$ 2.41	\$ 2.32	\$ 2.77	\$ 3.47	\$ 3.75	\$ 3.95	\$ 4.07	\$ 4.10
64K	\$ 2.78	\$ 2.49	\$ 2.94	\$ 3.50	\$ 3.80	\$ 4.08	\$ 4.10	\$ 4.18
128K	\$ 3.99	\$ 2.75	\$ 3.34	\$ 3.60	\$ 3.70	\$ 3.78	\$ 3.80	\$ 3.85
256K	\$ 7.74	\$ 4.40	\$ 4.30	\$ 4.38	\$ 4.35	\$ 4.22	\$ 4.14	\$ 4.01
512K	\$32.50	\$11.73	\$ 8.05	\$ 5.85	\$ 4.80	\$ 4.32	\$ 4.20	\$ 4.08
1M	0	\$48.50	\$24.32	\$16.30	\$11.00	\$ 8.45	\$ 7.20	\$ 5.24
2M	0	0	0	0	0	0	0	0
4M	0	0	0	0	0	0	0	0
8M	0	0	0	0	0	0	0	0
Overall ASP	\$ 3.46	\$ 3.21	\$ 4.04	\$ 4.46	\$ 4.44	\$ 4.42	\$ 4.32	\$ 4.11
% Change from Previous Year		(7%)	26%	10%	0	(1%)	(2%)	(5%)

Source: Dataquest
July 1988

MOS EPROM--Forecast

Table 3

Worldwide CMOS EPROM Market--Total (UV and OTP)

	Millions of Dollars							
	1985	1986	1987	1988	1989	1990	1991	1992
4K	0	0	0	0	0	0	0	0
8K	0	0	0	0	0	0	0	0
16K	\$11	0	\$ 8	\$ 11	\$ 10	\$ 11	\$ 9	\$ 8
32K	18	\$ 7	10	9	6	3	2	2
64K	22	65	93	123	122	110	102	100
128K	4	7	41	68	71	63	59	60
256K	30	80	235	326	375	373	388	378
512K	0	4	78	149	166	170	178	185
1M	0	9	36	225	445	638	742	765
2M	0	0	0	4	25	72	264	419
4M	0	0	0	0	1	12	60	308
8M	0	0	0	0	0	0	0	5
Total	\$85	\$173	\$500	\$915	\$1,221	\$1,452	\$1,804	\$2,230

% Change from
Previous Year

105% 189% 83% 33% 19% 24% 24%

	Millions of Units							
	1985	1986	1987	1988	1989	1990	1991	1992
4K	0	0	0	0	0	0	0	0
8K	0	0	0	0	0	0	0	0
16K	3.0	0	2.4	3.3	2.7	2.7	2.1	2.0
32K	4.5	2.7	3.1	2.5	1.4	0.7	0.5	0.4
64K	5.5	17.1	25.3	31.5	29.0	25.0	22.5	21.3
128K	0.5	1.9	10.8	17.1	17.9	16.0	14.7	14.0
256K	3.2	16.2	48.0	68.6	79.8	81.9	83.5	79.6
512K	0	0.3	8.9	22.6	30.8	32.6	35.3	38.2
1M	0	0.1	1.3	13.6	38.7	71.1	100.6	116.2
2M	0	0	0	0	0.4	2.0	11.0	26.0
4M	0	0	0	0	0	0.2	1.7	15.0
8M	0	0	0	0	0	0	0	0
Total	16.7	38.3	99.8	159.1	200.6	232.2	272.0	312.6

% Change from
Previous Year

129% 161% 59% 26% 16% 17% 15%

(Continued)

MOS EPROM--Forecast

Table 3 (Continued)

Worldwide CMOS EPROM Market--Total (UV and OTP)

	Average Selling Price (\$)							
	1985	1986	1987	1988	1989	1990	1991	1992
4K	0	0	0	0	0	0	0	0
8K	0	0	0	0	0	0	0	0
16K	\$ 3.50	0	\$ 3.36	\$ 3.42	\$ 3.76	\$ 3.95	\$ 4.04	\$ 4.12
32K	\$ 4.10	\$ 2.71	\$ 3.08	\$ 3.58	\$ 3.95	\$ 4.10	\$ 4.16	\$ 4.20
64K	\$ 4.07	\$ 3.80	\$ 3.68	\$ 3.90	\$ 4.20	\$ 4.42	\$ 4.55	\$ 4.70
128K	\$ 7.20	\$ 3.89	\$ 3.80	\$ 4.00	\$ 3.98	\$ 3.94	\$ 3.99	\$ 4.30
256K	\$ 9.25	\$ 4.93	\$ 4.90	\$ 4.75	\$ 4.70	\$ 4.55	\$ 4.65	\$ 4.75
512K	\$ 30.00	\$13.95	\$ 8.68	\$ 6.58	\$ 5.40	\$ 5.20	\$ 5.05	\$ 4.85
1M	\$125.00	\$62.62	\$27.36	\$ 16.55	\$ 11.49	\$ 8.98	\$ 7.38	\$ 6.59
2M	0	0	0	\$110.00	\$ 62.00	\$36.00	\$24.00	\$ 16.10
4M	0	0	0	0	\$125.00	\$62.00	\$35.00	\$ 20.50
8M	0	0	0	0	0	0	0	\$135.00
Overall ASP	\$ 5.06	\$ 4.52	\$ 5.01	\$ 5.75	\$ 6.08	\$ 6.25	\$ 6.63	\$ 7.13
% Change from Previous Year			11%	15%	6%	3%	6%	8%

Source: Dataquest
July 1988

MOS EPROM--Forecast

Table 4

Worldwide MOS UV EPROM Market--Total (NMOS and CMOS)

	Millions of Dollars							
	1985	1986	1987	1988	1989	1990	1991	1992
4K	0	0	0	0	0	0	0	0
8K	0	0	0	0	0	0	0	0
16K	\$ 64	\$ 35	\$ 28	\$ 23	\$ 18	\$ 15	\$ 12	\$ 11
32K	96	46	46	35	21	10	6	3
64K	284	257	210	206	180	152	125	113
128K	223	150	176	184	155	118	95	92
256K	174	272	476	570	564	493	481	439
512K	14	68	242	343	305	270	230	196
1M	0	12	43	242	442	573	588	550
2M	0	0	0	4	25	71	264	426
4M	0	0	0	0	1	12	60	308
8M	0	0	0	0	0	0	0	5
Total	\$856	\$841	\$1,221	\$1,606	\$1,711	\$1,713	\$1,861	\$2,144
% Change from Previous Year		(2%)	45%	32%	7%	0%	9%	15%

	Millions of Units								
	1985	1986	1987	1988	1989	1990	1991	1992	
4K	0	0	0	0	0	0	0	0	
8K	0	0	0	0	0	0	0	0	
16K	24.6	14.7	9.8	6.8	4.9	3.8	3.1	2.6	
32K	35.6	20.7	16.4	9.9	5.4	2.4	1.5	0.8	
64K	99.0	93.9	63.8	55.0	44.0	35.0	28.0	24.5	
128K	55.3	52.2	49.1	48.0	40.0	30.0	24.0	22.0	
256K	21.7	57.5	102.1	121.0	116.0	103.0	98.0	86.0	
512K	4	5.7	29.1	54.0	56.0	51.0	44.2	38.0	
1M	0	2	1.6	14.0	38.0	61.0	72.0	76.0	
2M	0	0	0	0	4	2.0	11.0	26.0	
4M	0	0	0	0	0	0.2	1.7	15.0	
8M	0	0	0	0	0	0	0	0	
Total	236.7	244.9	271.8	308.8	304.7	288.4	283.5	290.9	
% Change from Previous Year			3%	11%	14%	(1%)	(5%)	(2%)	3%

(Continued)

MOS EPROM--Forecast

Table 4 (Continued)

Worldwide MOS UV EPROM Market--Total (NMOS and CMOS)

	Average Selling Price (\$)							
	1985	1986	1987	1988	1989	1990	1991	1992
4K	0	0	0	0	0	0	0	0
8K	0	0	0	0	0	0	0	0
16K	\$ 2.60	\$ 2.40	\$ 2.80	\$ 3.40	\$ 3.68	\$ 3.90	\$ 4.00	\$ 4.10
32K	\$ 2.71	\$ 2.24	\$ 2.83	\$ 3.50	\$ 3.80	\$ 4.00	\$ 4.10	\$ 4.15
64K	\$ 2.87	\$ 2.74	\$ 3.29	\$ 3.74	\$ 4.10	\$ 4.34	\$ 4.47	\$ 4.63
128K	\$ 4.03	\$ 2.88	\$ 3.59	\$ 3.84	\$ 3.88	\$ 3.92	\$ 3.97	\$ 4.19
256K	\$ 8.02	\$ 4.73	\$ 4.66	\$ 4.71	\$ 4.86	\$ 4.79	\$ 4.91	\$ 5.11
512K	\$32.50	\$11.94	\$ 8.33	\$ 6.35	\$ 5.44	\$ 5.29	\$ 5.20	\$ 5.15
1M	0	\$58.57	\$26.77	\$ 17.29	\$ 11.62	\$ 9.39	\$ 8.16	\$ 7.24
2M	0	0	0	\$110.00	\$ 62.00	\$36.00	\$24.00	\$ 16.40
4M	0	0	0	0	\$125.00	\$62.00	\$35.00	\$ 20.50
8M	0	0	0	0	0	0	0	\$135.00
Overall ASP	\$ 3.62	\$ 3.43	\$ 4.49	\$ 5.20	\$ 5.61	\$ 5.94	\$ 6.56	\$ 7.37
% Change from Previous Year		(5%)	31%	16%	8%	6%	10%	12%

Source: Dataquest
July 1988

MOS EPROM--Forecast

Table 5

Worldwide NMOS UV Market

	Millions of Dollars							
	1985	1986	1987	1988	1989	1990	1991	1992
4K	0	0	0	0	0	0	0	0
8K	0	0	0	0	0	0	0	0
16K	\$ 54	\$ 35	\$ 19	\$ 12	\$ 8	\$ 4	\$ 4	\$ 2
32K	78	39	37	26	15	7	4	2
64K	265	193	120	87	61	43	24	14
128K	219	143	136	118	86	56	38	33
256K	144	202	254	253	182	106	74	37
512K	14	63	165	196	136	97	47	1
1M	0	3	8	40	60	71	50	34
2M	0	0	0	0	0	0	0	0
4M	0	0	0	0	0	0	0	0
8M	0	0	0	0	0	0	0	0
Total	\$774	\$679	\$739	\$731	\$548	\$384	\$241	\$122
% Change from Previous Year		(12%)	9%	(1%)	(25%)	(30%)	(37%)	(49%)

	Millions of Units							
	1985	1986	1987	1988	1989	1990	1991	1992
4K	0	0	0	0	0	0	0	0
8K	0	0	0	0	0	0	0	0
16K	21.6	14.7	7.4	3.5	2.2	1.1	1.0	0.6
32K	31.1	18.1	13.3	7.4	4.0	1.7	1.0	0.4
64K	94.5	77.6	39.9	24.6	15.6	10.4	5.7	3.3
128K	54.8	50.3	38.7	31.4	22.7	14.4	9.6	8.2
256K	18.5	43.4	57.1	55.6	39.5	23.4	16.3	8.0
512K	0.4	5.4	20.2	31.6	25.5	18.8	9.2	0.1
1M	0	0.1	0.3	2.4	5.3	7.9	6.4	4.8
2M	0	0	0	0	0	0	0	0
4M	0	0	0	0	0	0	0	0
8M	0	0	0	0	0	0	0	0
Total	220.9	209.5	176.9	156.6	114.8	77.7	49.2	25.4
% Change from Previous Year		(5%)	(16%)	(11%)	(27%)	(32%)	(37%)	(48%)

(Continued)

MOS EPROM--Forecast

Table 5 (Continued)
Worldwide NMOS UV Market

	Average Selling Price (\$)							
	1985	1986	1987	1988	1989	1990	1991	1992
4K	0	0	0	0	0	0	0	0
8K	0	0	0	0	0	0	0	0
16K	\$ 2.48	\$ 2.40	\$ 2.62	\$ 3.38	\$ 3.58	\$3.78	\$3.90	\$4.05
32K	\$ 2.51	\$ 2.17	\$ 2.77	\$ 3.47	\$ 3.75	\$3.95	\$4.07	\$4.10
64K	\$ 2.80	\$ 2.49	\$ 3.00	\$ 3.54	\$ 3.92	\$4.14	\$4.15	\$4.18
128K	\$ 4.00	\$ 2.84	\$ 3.52	\$ 3.75	\$ 3.80	\$3.90	\$3.95	\$4.00
256K	\$ 7.80	\$ 4.65	\$ 4.45	\$ 4.54	\$ 4.62	\$4.52	\$4.55	\$4.60
512K	\$32.50	\$11.82	\$ 8.18	\$ 6.18	\$ 5.32	\$5.18	\$5.12	\$5.08
1M	0	\$48.50	\$24.32	\$16.80	\$11.28	\$9.00	\$7.78	\$7.02
2M	0	0	0	0	0	0	0	0
4M	0	0	0	0	0	0	0	0
8M	0	0	0	0	0	0	0	0
Total	\$ 3.50	\$ 3.24	\$ 4.18	\$ 4.67	\$ 4.77	\$4.95	\$4.89	\$4.80
% Change from Previous Year		(8%)	29%	12%	2%	4%	(1%)	(2%)

Source: Dataquest
July 1988

MOS EPROM--Forecast

Table 6

Worldwide CMOS UV EPROM Market

	Millions of Dollars							
	1985	1986	1987	1988	1989	1990	1991	1992
4K	0	0	0	0	0	0	0	0
8K	0	0	0	0	0	0	0	0
16K	\$10	0	\$ 8	\$ 11	\$ 10	\$ 11	\$ 9	\$ 8
32K	18	\$ 7	10	9	6	3	2	2
64K	19	63	90	118	119	109	101	100
128K	4	7	40	67	69	61	57	60
256K	30	70	222	317	382	388	407	402
512K	0	4	77	147	169	173	182	195
1M	0	9	36	202	382	502	538	516
2M	0	0	0	4	25	71	264	426
4M	0	0	0	0	1	12	60	308
8M	0	0	0	0	0	0	0	5
Total	\$82	\$162	\$482	\$875	\$1,163	\$1,329	\$1,620	\$2,022
% Change from Previous Year		98%	198%	82%	33%	14%	22%	25%

	Millions of Units							
	1985	1986	1987	1988	1989	1990	1991	1992
4K	0	0	0	0	0	0	0	0
8K	0	0	0	0	0	0	0	0
16K	3.0	0	2.4	3.3	2.7	2.7	2.1	2.0
32K	4.5	2.7	3.1	2.5	1.4	0.7	0.5	0.4
64K	4.5	16.3	23.9	30.4	28.4	24.6	22.3	21.2
128K	0.5	1.9	10.4	16.7	17.3	15.6	14.4	13.9
256K	3.2	14.1	45.0	65.4	76.5	79.6	81.7	78.0
512K	0	0.3	8.9	22.4	30.5	32.3	35.0	37.9
1M	0	0.1	1.3	11.6	32.7	53.1	65.6	71.2
2M	0	0	0	0	0.4	2.0	11.0	26.0
4M	0	0	0	0	0	0.2	1.7	15.0
8M	0	0	0	0	0	0	0	0
Total	15.7	35.4	95.0	152.1	189.9	210.7	234.3	265.5
% Change from Previous Year		125%	168%	60%	25%	11%	11%	13%

(Continued)

MOS EPROM--Forecast

Table 6 (Continued)

Worldwide CMOS UV EPROM Market

	Average Selling Price (\$)							
	1985	1986	1987	1988	1989	1990	1991	1992
4K	0	0	0	0	0	0	0	0
8K	0	0	0	0	0	0	0	0
16K	\$3.50	0	\$ 3.36	\$ 3.42	\$ 3.76	\$ 3.95	\$ 4.04	\$ 4.12
32K	\$4.10	\$ 2.71	\$ 3.08	\$ 3.58	\$ 3.95	\$ 4.10	\$ 4.16	\$ 4.20
64K	\$4.25	\$ 3.87	\$ 3.78	\$ 3.90	\$ 4.20	\$ 4.42	\$ 4.55	\$ 4.70
128K	\$7.20	\$ 3.94	\$ 3.83	\$ 4.00	\$ 3.98	\$ 3.94	\$ 3.99	\$ 4.30
256K	\$9.25	\$ 4.98	\$ 4.93	\$ 4.85	\$ 4.99	\$ 4.87	\$ 4.98	\$ 5.16
512K	0	\$14.08	\$ 8.68	\$ 6.58	\$ 5.54	\$ 5.35	\$ 5.22	\$ 5.15
1M	0	\$62.62	\$27.35	\$ 17.39	\$ 11.68	\$ 9.45	\$ 8.20	\$ 7.25
2M	0	0	0	\$110.00	\$ 62.00	\$36.00	\$24.00	\$ 16.40
4M	0	0	0	0	\$125.00	\$62.00	\$35.00	\$ 20.50
8M	0	0	0	0	0	0	0	\$135.00
Overall ASP	\$5.18	\$ 4.57	\$ 5.08	\$ 5.75	\$ 6.12	\$ 6.31	\$ 6.92	\$ 7.61
% Change from Previous Year		(12%)	11%	13%	6%	3%	10%	10%

Source: Dataquest
July 1988

MOS EPROM--Forecast

Table 7

Total MOS OTP EPROM Market—Total (NMOS and CMOS)

	<u>Millions of Dollars</u>							
	<u>1985</u>	<u>1986</u>	<u>1987</u>	<u>1988</u>	<u>1989</u>	<u>1990</u>	<u>1991</u>	<u>1992</u>
4K	0	0	0	0	0	0	0	0
8K	0	0	0	0	0	0	0	0
16K	0	0	0	0	0	0	0	0
32K	\$ 5	\$ 1	0	0	0	0	0	0
64K	10	12	\$ 23	\$ 23	\$ 17	\$ 12	\$ 6	\$ 2
128K	3	12	25	28	35	26	20	10
256K	3	46	65	69	79	80	61	54
512K	0	0	14	35	45	51	49	41
1M	0	0	0	21	46	111	175	201
2M	0	0	0	0	0	0	0	0
4M	0	0	0	0	0	0	0	0
Total	\$20	\$72	\$126	\$177	\$222	\$279	\$311	\$307
% Change from Previous Year	(3%)	259%	76%	40%	26%	26%	11%	(1%)

	<u>Millions of Units</u>							
	<u>1985</u>	<u>1986</u>	<u>1987</u>	<u>1988</u>	<u>1989</u>	<u>1990</u>	<u>1991</u>	<u>1992</u>
4K	0	0	0	0	0	0	0	0
8K	0	0	0	0	0	0	0	0
16K	0	0	0	0	0	0	0	0
32K	3.0	0.9	0	0	0	0	0	0
64K	4.0	5.7	9.4	8.0	6.0	4.0	2.0	0.5
128K	0.8	5.2	8.6	9.0	11.0	8.0	6.0	3.0
256K	0.5	12.5	17.9	19.0	21.5	23.0	18.0	16.0
512K	0	0	1.8	7.0	11.0	13.0	12.8	11.0
1M	0	0	0	2.0	6.0	18.0	35.0	45.0
2M	0	0	0	0	0	0	0	0
4M	0	0	0	0	0	0	0	0
Total	8.3	24.2	37.7	45.0	55.5	66.0	73.8	75.5

(Continued)

MOS EPROM--Forecast

Table 7 (Continued)

Total MOS OTP EPROM Market—Total (NMOS and CMOS)

	Average Selling Price (\$)							
	1985	1986	1987	1988	1989	1990	1991	1992
4K	0	0	0	0	0	0	0	0
8K	0	0	0	0	0	0	0	0
16K	0	0	0	0	0	0	0	0
32K	\$1.50	\$ 1.75	0	0	0	0	0	0
64K	\$2.46	\$ 2.01	\$2.47	\$ 2.90	\$2.89	\$3.09	\$3.23	\$3.26
128K	\$3.50	\$ 2.27	\$2.87	\$ 3.11	\$3.17	\$3.22	\$3.26	\$3.34
256K	\$5.50	\$ 3.73	\$3.63	\$ 3.63	\$3.69	\$3.46	\$3.41	\$3.36
512K	0	\$10.19	\$7.54	\$ 5.02	\$4.06	\$3.91	\$3.80	\$3.75
1M	0	0	0	\$10.66	\$7.60	\$6.14	\$4.99	\$4.46
2M	0	0	0	0	0	0	0	0
4M	0	0	0	0	0	0	0	0
Overall ASP	\$2.40	\$ 2.95	\$3.35	\$ 3.92	\$4.00	\$4.23	\$4.21	\$4.07

Source: Dataquest
July 1988

MOS EPROM--Forecast

Table 8

Worldwide NMOS OTP EPROM Market

	<u>Millions of Dollars</u>							
	<u>1985</u>	<u>1986</u>	<u>1987</u>	<u>1988</u>	<u>1989</u>	<u>1990</u>	<u>1991</u>	<u>1992</u>
4K	0	0	0	0	0	0	0	0
8K	0	0	0	0	0	0	0	0
16K	0	0	0	0	0	0	0	0
32K	\$ 5	\$ 1	0	0	0	0	0	0
64K	7	10	\$ 19	\$ 20	\$ 15	\$ 11	\$ 6	\$ 2
128K	3	12	24	26	33	24	18	9
256K	3	38	53	57	67	71	55	48
512K	0	0	13	34	43	49	47	40
1M	0	0	0	0	0	0	0	0
2M	0	0	0	0	0	0	0	0
4M	0	0	0	0	0	0	0	0
Total	\$17	\$61	\$108	\$137	\$159	\$156	\$127	\$99

% Change from Previous Year	(19%)	266%	78%	26%	16%	(2%)	(19%)	(22%)
--------------------------------	-------	------	-----	-----	-----	------	-------	-------

	<u>Millions of Units</u>							
	<u>1985</u>	<u>1986</u>	<u>1987</u>	<u>1988</u>	<u>1989</u>	<u>1990</u>	<u>1991</u>	<u>1992</u>
4K	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
8K	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
16K	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
32K	3.0	0.9	0	0	0	0	0	0
64K	3.0	4.9	8.0	6.9	5.4	3.6	1.8	0.5
128K	0.8	5.2	8.2	8.6	10.5	7.6	5.7	2.9
256K	0.5	10.4	14.8	15.8	18.3	20.7	16.2	14.4
512K	N/A	0	1.8	6.8	10.7	12.6	12.4	10.7
1M	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2M	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
4M	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total	7.3	21.4	32.8	38.0	44.8	44.5	36.1	28.4

N/A = Not Available

(Continued)

MOS EPROM--Forecast

Table 8 (Continued)

Worldwide NMOS OTP EPROM Market

	Average Selling Price (\$)							
	1985	1986	1987	1988	1989	1990	1991	1992
4K	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
8K	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
16K	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
32K	\$1.50	\$ 1.75	0	0	0	0	0	0
64K	\$2.20	\$ 1.96	\$2.40	\$2.87	\$2.85	\$3.07	\$3.22	\$3.26
128K	\$3.50	\$ 2.27	\$2.86	\$3.09	\$3.15	\$3.20	\$3.24	\$3.32
256K	\$5.50	\$ 3.63	\$3.55	\$3.59	\$3.68	\$3.44	\$3.40	\$3.35
512K	N/A	\$10.00	\$7.53	\$5.00	\$4.05	\$3.90	\$3.80	\$3.75
1M	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2M	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
4M	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Overall ASP	\$2.28	\$ 2.85	\$3.31	\$3.60	\$3.54	\$3.50	\$3.50	\$3.50

N/A = Not Available

Source: Dataquest
July 1988

MOS EPROM--Forecast

Table 9

Worldwide CMOS OTP EPROM Market

	<u>Millions of Dollars</u>							
	<u>1985</u>	<u>1986</u>	<u>1987</u>	<u>1988</u>	<u>1989</u>	<u>1990</u>	<u>1991</u>	<u>1992</u>
4K	0	0	0	0	0	0	0	0
8K	0	0	0	0	0	0	0	0
16K	0	0	0	0	0	0	0	0
32K	0	0	0	0	0	0	0	0
64K	\$3	\$ 2	\$ 4	\$ 3	\$ 2	\$ 1	\$ 1	0
128K	0	0	1	2	2	1	1	\$ 1
256K	0	9	12	12	12	8	6	6
512K	0	0	0	1	1	2	1	1
1M	0	0	0	21	46	111	175	201
2M	0	0	0	0	0	0	0	0
4M	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total	\$3	\$11	\$18	\$40	\$63	\$123	\$184	\$208

% Change from
Previous Year

228% 67% 124% 58% 96% 49% 13%

	<u>Millions of Units</u>							
	<u>1985</u>	<u>1986</u>	<u>1987</u>	<u>1988</u>	<u>1989</u>	<u>1990</u>	<u>1991</u>	<u>1992</u>
4K	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
8K	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
16K	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
32K	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
64K	1.0	0.8	1.4	1.1	0.6	0.4	0.2	0
128K	N/A	0	0.4	0.5	0.6	0.4	0.3	0.2
256K	N/A	2.1	3.1	3.2	3.2	2.3	1.8	1.6
512K	N/A	0	0.1	0.2	0.3	0.4	0.4	0.3
1M	N/A	0	0	2.0	6.0	18.0	35.0	45.0
2M	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
4M	<u>N/A</u>	<u>N/A</u>	<u>N/A</u>	<u>N/A</u>	<u>N/A</u>	<u>N/A</u>	<u>N/A</u>	<u>N/A</u>
Total	1.0	2.9	4.9	7.0	10.7	21.5	37.7	47.1

N/A = Not Available

(Continued)

MOS EPROM--Forecast

Table 9 (Continued)

Worldwide CMOS OTP EPROM Market

	Average Selling Price (\$)							
	1985	1986	1987	1988	1989	1990	1991	1992
4K	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
8K	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
16K	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
32K	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
64K	\$3.25	\$ 2.35	\$2.84	\$ 3.10	\$3.27	\$3.30	\$3.32	\$3.34
128K	\$5.00	\$ 2.89	\$3.04	\$ 3.50	\$3.55	\$3.58	\$3.61	\$3.62
256K	\$8.50	\$ 4.22	\$3.99	\$ 3.80	\$3.75	\$3.65	\$3.54	\$3.46
512K	N/A	\$11.30	\$7.90	\$ 5.50	\$4.40	\$4.10	\$3.90	\$3.80
1M	N/A	N/A	N/A	\$10.66	\$7.60	\$6.14	\$4.99	\$4.46
2M	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
4M	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Overall ASP	\$3.25	\$ 3.71	\$3.63	\$ 5.68	\$5.89	\$5.74	\$4.89	\$4.42

N/A = Not Available

Source: Dataquest
July 1988

MOS EPROM--Forecast

The Market—1987

Worldwide MOS EPROM revenue totaled \$1.347 billion in 1987, posting a significant 48 percent growth in revenue over the 1986 total of \$913 million. Of the 27 known EPROM suppliers, Intel had an estimated 20 percent share of that market, followed, but not closely, by Fujitsu with a 12 percent share. While unit shipments increased 15 percent to 309.5 million in 1987, over the 269.1 million units shipped in 1986, technology shifts from NMOS to CMOS and higher average selling prices (ASPs), accounted for the most notable changes in EPROMs in 1987.

Comparison with Earlier Forecasts

The current EPROM forecast reflects several significant differences from the version published in April 1987. The changes and reasons for these differences are as follows:

- Actual revenue, unit shipments, and ASPs for 1986 have been adjusted to reflect final numbers completed by the middle of 1987.
- Actual bit shipments increased 71 percent as a result of significant growth in the 256K, 512K, and 1-Mbit densities.
- Overall ASPs increased 28 percent in 1987, rounding out at \$4.35, compared with \$3.39 in 1986. Higher EPROM prices are a direct result of MITI's imposed reduction of EPROM shipments to the United States by Japanese suppliers.
- The NMOS share of EPROMs tumbled to 68 percent of all EPROM units shipped in 1987, down from its pedestal of 86 percent share of units in 1986. Increased demand for CMOS, a reduction in price premium between CMOS and NMOS, and a switch over to CMOS by more suppliers/users are strong indicators of a growing CMOS market.
- The U.S. manufacturers' share of the EPROM market increased, reaching 44.5 percent in 1987, while the Japanese manufacturers' share dropped to 47.4 percent, down from 55.5 percent in the previous year.
- Shipments of low-density, high-speed CMOS EPROMs increased substantially in 1987. As a result, we have increased the unit forecasts and extended the life cycles of the 16K and 64K EPROMs.

MOS EPROM--Forecast

Market Outlook

Although the second quarter of 1987 saw EPROM prices firming, pushing revenue out of the depressed price market of 1986, a large portion of the 1987 EPROM revenue growth can be attributed to trade agreement pressures. As a result of further U.S.-Japan trade agreement discussions, MITI introduced production cutback guidelines for memory suppliers. By the second quarter of 1987, cutbacks on Japanese memory exports and restrictions on export licenses slowed the flow of EPROM products to the United States. After suffering through two years of overcapacity, depressed prices, and nonexistent margins, U.S. EPROM manufacturers reaped the benefits of MITI's production reductions. Second-quarter increased user demands and supplier capacity constraints forced onshore companies to look for excess capacity, and users to face longer lead times and higher prices. Beset by MITI's monitoring and capacity constraints on DRAMs, offshore manufacturers such as Hitachi, NEC, Oki, and Toshiba, slowed and/or stopped production of their 64K, 128K, and 256K EPROMs, and focused production on their more value-added DRAM products. As DRAM capacity improves, we expect these manufacturers to jump back into the EPROM arena.

High-Speed EPROMs

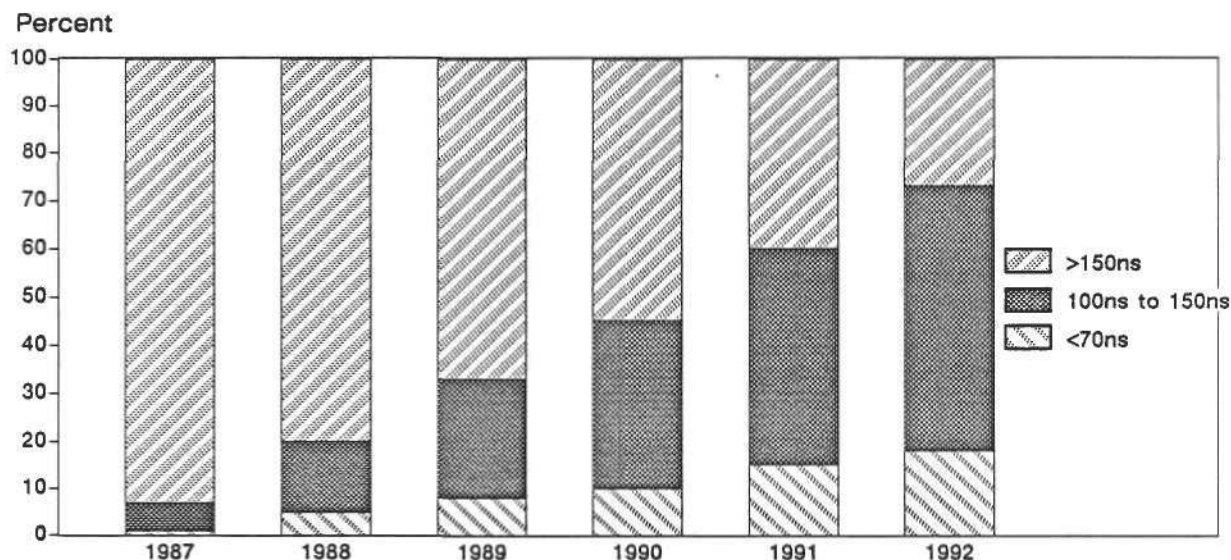
Several key developments occurred in high-speed EPROM products in 1987. ICT, Goldstar, and Mitsubishi joined the ranks of high-speed EPROM suppliers. While Goldstar is still in the R&D stage with its 30ns 64K device, ICT began sampling its 8Kx8 device with access times ranging from 40 to 55ns. However, Mitsubishi is stalking the high-density area with a 120ns 256K device and 512K devices accessing 125ns and 150ns speeds. WaferScale Integration is producing a 35ns 8Kx8 device, and has also introduced 16Kx16 and 32Kx8 256K devices that can achieve 55ns.

Figure 6 illustrates Dataquest's preliminary estimate of the high-speed EPROM market as a percent of total units sold. The very high-speed, less than 70ns product category with speeds averaging 35ns to 55ns, will be driven by the low 8K, 16K, and 64K devices. These low-density, high-speed products are geared for very specific bipolar PROM replacement applications. The greater than 70ns, or high-speed category, specifically the 100ns to 150ns range, will be driven by high-performance microprocessor and DSP applications. We expect the 100ns to 150ns range to be the most prevalent EPROM speed range by 1992. While the 64K and 256K densities will sustain the largest growth for high-speed and very high-speed demand in 1988, increased growth in the larger 512K and above densities is expected by 1989.

MOS EPROM--Forecast

Figure 6

High-Speed EPROM Market Speeds (Percent of Units)



Source: Dataquest
July 1988

CMOS/NMOS EPROMs

CMOS EPROM units grew an unexpected 161 percent in 1987 over 1986. CMOS represented a 32 percent share of total EPROM units in 1987, compared with its 14 percent unit share in 1986. As such, we expect the CMOS share to represent 45 percent of total unit shares in 1988, and surpass NMOS with a 56 percent share of units by 1989. Key developments in fast programming time, fast access time, low power dissipation, and higher productivity have made CMOS increasingly competitive with NMOS. While CMOS EPROMs continue to command a price premium over NMOS, the price differentials have shrunk to a level where users are now willing to pay for high performance.

MOS UV/OTP EPROMs

Table 4 (MOS UV EPROMs) deals with EPROMs packaged in UV erasable packages, while Table 7 deals strictly with production of one-time programmable (OTP) EPROMs in plastic packages without windows.

MOS EPROM--Forecast

Dataquest has consistently made the packaging distinction between EPROMs in the UV erasable packages and those in nonerasable plastic packages (OTPs) for the primary reason of separately tracking an anticipated shift to less-expensive packages. Our forecast for 1987 through 1992 shows that UV EPROMs will continue to have a higher fraction of the EPROM market. Growth in the OTP arena will continue, but at a slower pace than expected. We expect that Intel, Mitsubishi, and Toshiba will continue to be the major suppliers supporting a very focused product application market. We expect that principal end-user demand will be in the 256K, 512K, and 1-Mbit densities. As the Flash memory market develops, we expect further decline in the growth and development of the OTP, especially in the higher 1-Mbit and above densities. The OTP EPROM has faltered in gaining acceptance as a viable technology. Its reputation is permeated with black marks and obstacles, including questionable reliability, manufacturer inability to support product with second sourcing, declining EPROM prices, and poor customer acceptance. The OTP area is ripe for an attack from the Flash, with its low-cost, windowless package, high-performance speeds, and rapid bulk erase and reprogrammability.

Flash Memory

Flash memory technology was first introduced by Toshiba with its announcement of the 256K Flash EEPROM in 1985. The emerging Flash technology is now being supported by Intel, National, and Seeq, with potential entries in the next twelve months from AMD, Hitachi, Microchip Technologies, Inc., and Texas Instrument. It is a nonvolatile memory that implements an EPROM-like process and design approach. Flash memory requires a 12V power supply for programming and erasing, and employs electron tunneling for bulk erase. Typical erase time is 1 second to erase the entire memory. Total reprogrammability and bulk erase time is less than a minute, compared with the typical 15 to 20 minutes for UVEPROMs. If there are no unforeseen technical obstacles, Dataquest believes that Flash memory, like other new and emerging memory technologies, shows great promise in enhancing the nonvolatile memory market.

At present, Flash memories are at sampling and/or low volume production stages. Fueled by the right market forces—competition, general economic conditions, supply/demand dynamics—Flash should proceed along the learning curve and capture a sizable share of the nonvolatile memory market.

We expect shipments of the recently introduced 64K, 256K, and 512K Flash products to ramp up in the latter part of 1988, while introduction of the 1-Mbit device is assumed in 1989.

Short-Term Forecast

Dataquest believes that EPROM market developments will follow those of the DRAM market closely. While EPROM availability will not be as constrained as DRAMs, prices will remain high through the end of 1988. Although 1-Mbit EPROM unit shipments reached 1.611 million in 1987, with Japanese vendors capturing more than 75 percent of market share, 1-Mbit unit shipments fell far below our forecast of 5.7 million units. On a more optimistic note, new entrants and user emphasis on high speed, could boost 1-Mbit shipments to 16 million units by the end of 1988.

MOS EPROM--Forecast

Long-Term Forecast

Bit growth will continue to be slow from 1987 through 1990, with an upturn expected in 1991. Bit growth is expected to have a compound annual growth rate (CAGR) of 37.3 percent from 1987 through 1992. The major driving forces behind bit growth will come from the automotive and computer sectors. More EPROMs are expected to be used in the computer as operating systems become more complex and feature filled, and as communications and multitasking functions become more prevalent. We expect the bit share of the transportation sector to expand in 1991, and become the largest sector, displacing consumer applications.

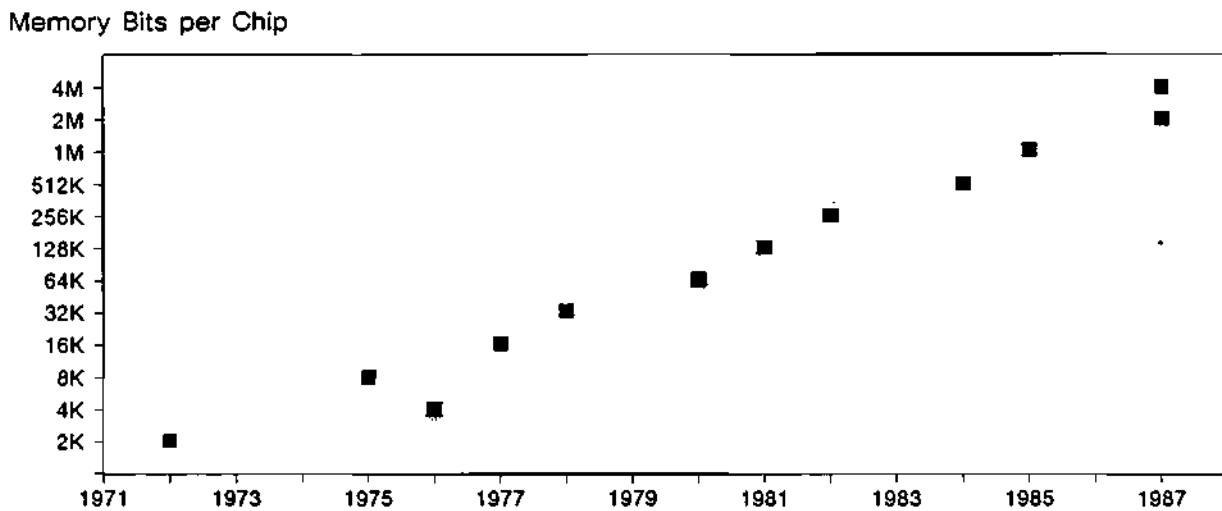
We believe that Toshiba's announcement of its 120ns 4-Mbit EPROM, along with the high-speed CMOS developments in 1987 and the innovative Flash memory announcements of 1987 and early 1988, were precursors of strong growth for the EPROM market. At present, the EPROM market is a commodity market fraught with too many suppliers sharing too little revenue. The outlook for EPROMs will be bright only for those suppliers that can maintain a full range of innovative products that cover a variety of speeds, and thus withstand the continued onslaught from offshore competition.

MOS EPROM--Forecast

SUMMARY

Intel Corporation first introduced EPROM technology in 1971. Unlike ROMs, which are permanently programmed by the manufacturer during the fabrication process, EPROMs are programmed electrically and can be repeatedly reprogrammed and erased after exposure to ultraviolet light. The EPROM, often referred to as a floating-gate memory, was invented by Dov Frohman of Intel. As shown in Figure 1, the first product out of the chute was the 2K programmed memory. The glass-windowed 1701 EPROM was introduced by Intel at the International Solid State Circuits Conference in 1971. Development of the 4K and 8K EPROMs followed in 1975, with the first one-time programmable (OTP) plastic-packaged EPROM, the 2708P, introduced by Motorola in 1977.

Figure 1
EPROM Product Development



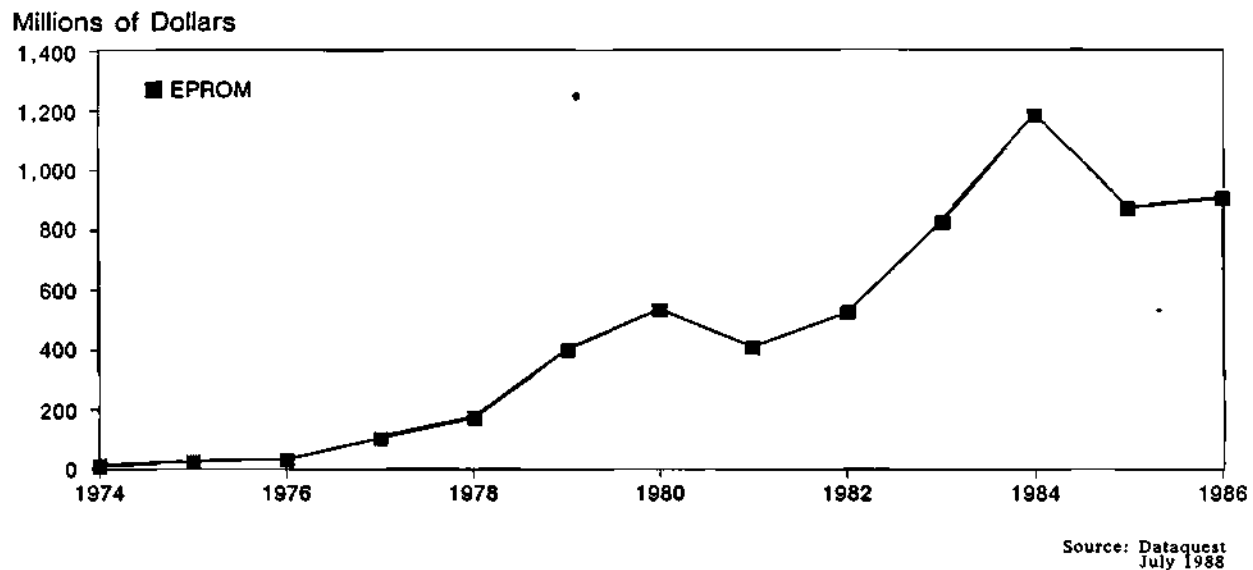
Source: Dataquest
July 1988

MOS EPROM--Forecast

The pinnacle of EPROM development was reached in 1977, with Intel's introduction of the 16K EPROM. The 5-volt 16K device was to become not only the industry standard for EPROMS, but it was also compatible with microprocessor systems. In essence, the marrying of the EPROM and the microprocessor accelerated the development of both products and the advance of the microcomputer industry.

Since 1974, the EPROM market has maintained a fairly steady rate of growth, as shown on Figure 2. Worldwide EPROM revenue grew at a 131 percent compound annual growth rate (CAGR) from 1974 to 1986.

Figure 2
EPROM Revenue Growth

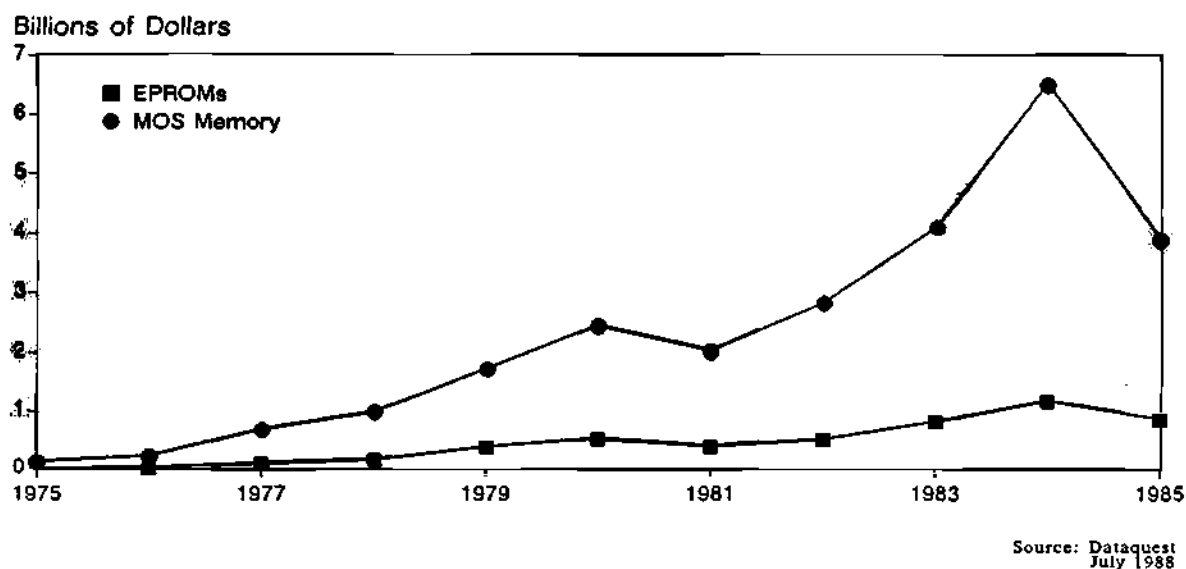


MOS EPROM--Forecast

Although the pace of the MOS memory race has intensified over the last 17 years, the EPROM segment of the memory market, as shown on Figure 3, has sustained a moderate share of the total memory market from year to year, second only to the DRAM segment. Emerging technological changes, new contenders in the market, and improved price performance, increased revenue and market share for the major EPROM suppliers through 1984. As shown on Figure 4, the market saw substantial EPROM bit growth during the 1975 to 1985 time frame.

Figure 3

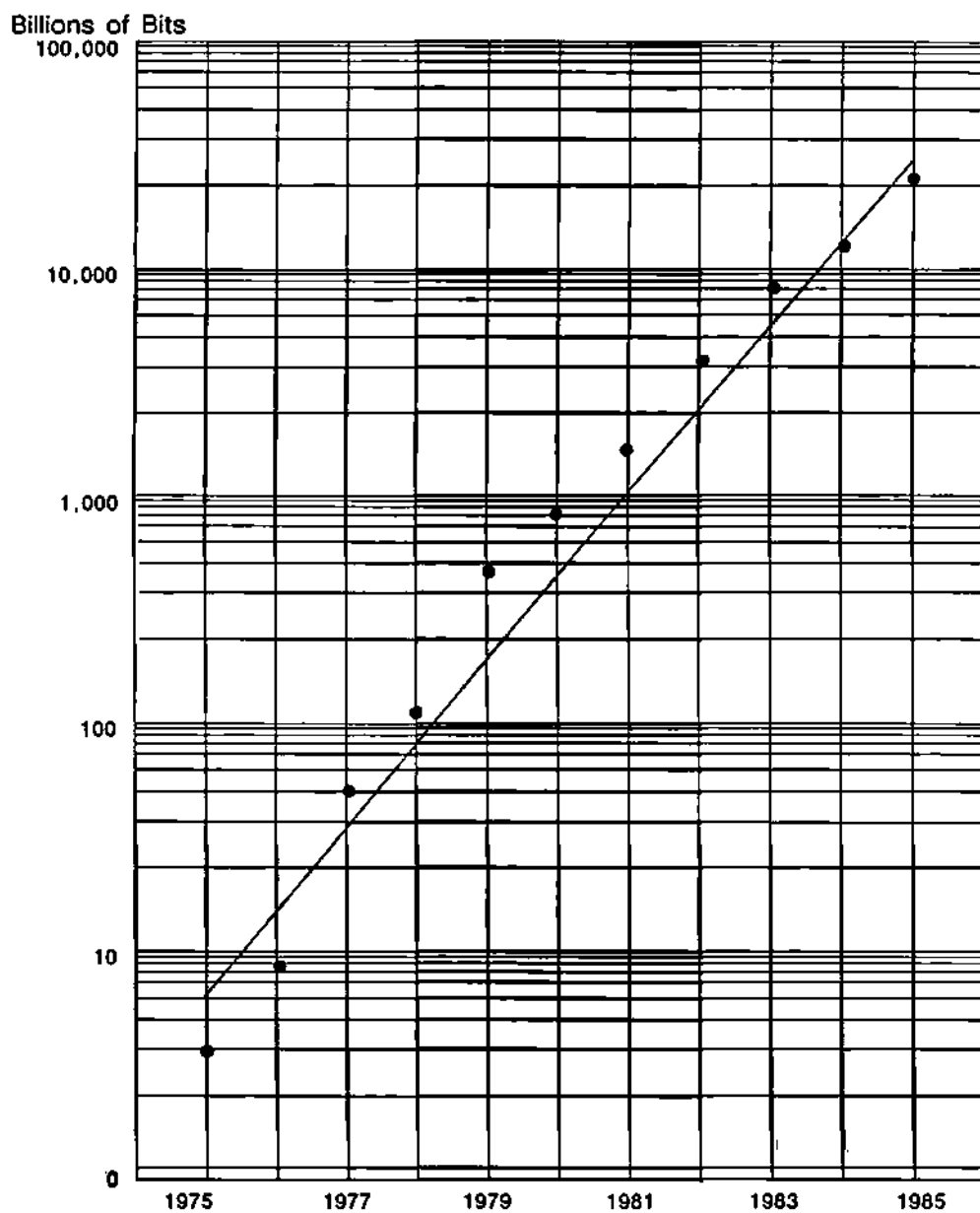
EPROM Share of MOS Memory



MOS EPROM--Forecast

Figure 4

MOS EPROM Bit Growth



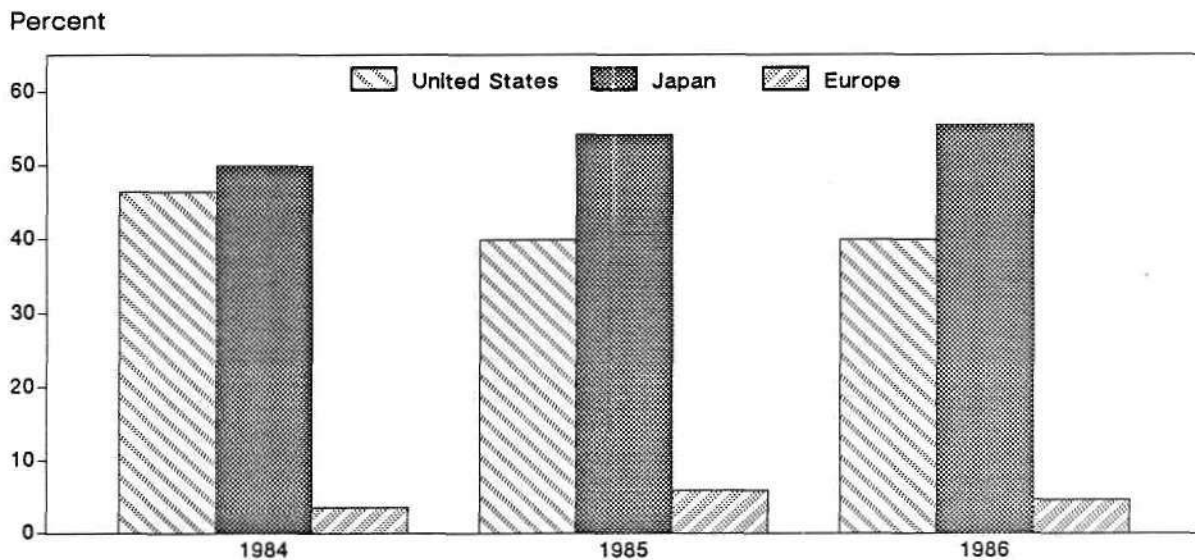
Source: Dataquest
July 1988

MOS EPROM--Forecast

Over the past decade, Japanese companies have made steady gains in MOS memory market share. These gains have been at the expense of U.S. semiconductor manufacturers, who have seen their market shares decrease in overall MOS memories from 74 percent in 1979 to 39 percent in 1985. The Japanese made their biggest gains in EPROM market share from 1984 through 1986, as shown on Figure 5. The yen appreciation from 1984 to 1986, aggressive pricing tactics, and new entrants to the market—including Matsushita, Seiko-Epson, and Sharp—have made the Japanese formidable contenders in the commodity EPROM market. In-depth competitive analysis is located in the SIS Memories segment notebook, behind the EPROM tab and under the "Vendor Analysis" heading. Detailed company shipment data are located in the SIS Products and Markets II notebook, and the Memories segment notebook, behind the EPROM tab under the "MOS EPROMs—Data" heading.

Figure 5

Worldwide MOS EPROM Market Share



Source: Dataquest
July 1988

MOS EPROM--Forecast

Dataquest's MOS EPROM data consist of revenue, unit shipments, and prices for MOS EPROM product lines. Table 1 lists the top-level market data for all of the tables. The data include all EPROM revenue, regardless of the technology employed (NMOS or CMOS) or package type (plastic or ceramic). The tables included in these data are as follows:

- Table 1--MOS EPROMS--Total Worldwide Market
- Table 2--Worldwide NMOS EPROM Market--Total (UV and OTP)
- Table 3--Worldwide CMOS EPROM Market--Total (UV and OTP)
- Table 4--Worldwide MOS UV EPROM Market--Total (NMOS and CMOS)
- Table 5--Worldwide NMOS UV Market
- Table 6--Worldwide CMOS UV EPROM Market
- Table 7--Worldwide MOS OTP EPROM Market--Total (NMOS and CMOS)
- Table 8--Worldwide NMOS OTP EPROM Market
- Table 9--Worldwide CMOS OTP EPROM Market

MOS EPROM--Forecast

Table 1

MOS EPROMs--Total Worldwide Market

	Millions of Dollars							
	1985	1986	1987	1988	1989	1990	1991	1992
4K	0	0	0	0	0	0	0	0
8K	0	0	0	0	0	0	0	0
16K	\$ 64	\$ 35	\$ 28	\$ 23	\$ 18	\$ 15	\$ 12	\$ 11
32K	101	48	46	35	19	10	6	3
64K	294	266	219	227	195	160	125	105
128K	226	163	201	211	191	144	116	98
256K	177	320	555	651	642	542	493	423
512K	15	68	255	372	348	330	291	245
1M	0	12	43	259	493	707	819	835
2M	0	0	0	4	25	72	253	419
4M	0	0	0	0	1	12	58	308
8M	0	0	0	0	0	0	0	5
Total	\$876	\$913	\$1,347	\$1,783	\$1,933	\$1,992	\$2,172	\$2,451
% Change from Previous Year	(26%)	4%	48%	32%	8%	3%	9%	13%

	Millions of Units							
	1985	1986	1987	1988	1989	1990	1991	1992
4K	0	0	0	0	0	0	0	0
8K	0	0	0	0	0	0	0	0
16K	24.6	14.7	9.8	6.8	4.9	3.8	3.1	2.6
32K	38.6	21.6	16.4	9.9	5.0	2.4	1.5	0.8
64K	103.0	99.6	73.2	63.0	50.0	39.0	30.0	25.0
128K	56.1	57.3	57.7	57.0	51.0	38.0	30.0	25.0
256K	22.2	70.0	119.9	140.0	137.5	126.0	116.0	102.0
512K	0.5	5.7	30.9	61.0	67.0	64.0	57.0	49.0
1M	0	0.2	1.6	16.0	44.0	79.0	107.0	121.0
2M	0	0	0	0	0.4	2.0	11.0	26.0
4M	0	0	0	0	0	0.2	1.7	15.0
8M	0	0	0	0	0	0	0	0
Total	245.0	269.1	309.5	353.8	359.8	354.4	357.3	366.4
% Change from Previous Year	11%	10%	15%	14%	2%	(2%)	1%	3%

(Continued)

MOS EPROM--Forecast

Table 1 (Continued)

MOS EPROMs--Total Worldwide Market

	Average Selling Price (\$)							
	1985	1986	1987	1988	1989	1990	1991	1992
4K	0	0	0	0	0	0	0	0
8K	0	0	0	0	0	0	0	0
16K	\$ 2.62	\$ 2.40	\$ 2.80	\$ 3.40	\$ 3.70	\$ 3.90	\$ 4.00	\$ 4.10
32K	\$ 2.61	\$ 2.24	\$ 2.83	\$ 3.50	\$ 3.80	\$ 4.00	\$ 4.10	\$ 4.15
64K	\$ 2.85	\$ 2.67	\$ 2.99	\$ 3.60	\$ 3.90	\$ 4.10	\$ 4.15	\$ 4.20
128K	\$ 4.02	\$ 2.85	\$ 3.49	\$ 3.70	\$ 3.75	\$ 3.80	\$ 3.85	\$ 3.90
256K	\$ 7.96	\$ 4.57	\$ 4.63	\$ 4.65	\$ 4.67	\$ 4.30	\$ 4.25	\$ 4.15
512K	\$ 32.44	\$11.96	\$ 8.24	\$ 6.10	\$ 5.20	\$ 5.15	\$ 5.10	\$ 5.00
1M	\$125.00	\$56.87	\$26.77	\$ 16.20	\$ 11.20	\$ 8.95	\$ 7.65	\$ 6.90
2M	0	0	0	\$110.00	\$ 62.00	\$36.00	\$23.00	\$ 16.10
4M	0	0	0	0	\$125.00	\$62.00	\$34.00	\$ 20.50
8M	0	0	0	0	0	0	0	\$135.00
Overall ASP	\$ 3.57	\$ 3.39	\$ 4.35	\$ 5.04	\$ 5.37	\$ 5.62	\$ 6.08	\$ 6.69
% Change from Previous Year	(33%)	(5%)	28%	16%	7%	5%	8%	10%

Source: Dataquest
July 1988

MOS EPROM--Forecast

Table 2

Worldwide NMOS EPROM Market--Total (UV and OTP)

	<u>Millions of Dollars</u>							
	<u>1985</u>	<u>1986</u>	<u>1987</u>	<u>1988</u>	<u>1989</u>	<u>1990</u>	<u>1991</u>	<u>1992</u>
4K	0	0	0	0	0	0	0	0
8K	0	0	0	0	0	0	0	0
16K	\$ 54	\$ 35	\$ 19	\$ 12	\$ 8	\$ 4	\$ 4	\$ 2
32K	82	44	37	26	14	7	4	2
64K	271	206	141	110	80	57	31	16
128K	222	152	157	144	123	83	58	42
256K	147	237	309	313	251	186	134	90
512K	14	63	177	225	174	135	91	44
1M	0	3	8	39	58	67	46	25
2M	0	0	0	0	0	0	0	0
4M	0	0	0	0	0	0	0	0
8M	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total	\$791	\$740	\$847	\$868	\$707	\$540	\$368	\$221
% Change from Previous Year		(6%)	14%	3%	(19%)	(24%)	(32%)	(40%)

	<u>Millions of Units</u>							
	<u>1985</u>	<u>1986</u>	<u>1987</u>	<u>1988</u>	<u>1989</u>	<u>1990</u>	<u>1991</u>	<u>1992</u>
4K	0	0	0	0	0	0	0	0
8K	0	0	0	0	0	0	0	0
16K	21.6	14.7	7.4	3.5	2.2	1.1	1.0	0.6
32K	34.1	18.9	13.3	7.4	3.6	1.7	1.0	0.4
64K	97.5	82.5	47.9	31.5	21.0	14.0	7.5	3.8
128K	55.6	55.4	46.9	39.9	33.2	22.0	15.3	11.0
256K	19.0	53.8	71.9	71.4	57.8	44.1	32.5	22.4
512K	0.4	5.4	21.9	38.4	36.2	31.4	21.7	10.8
1M	0	0.1	0.3	2.4	5.3	7.9	6.4	4.8
2M	0	0	0	0	0	0	0	0
4M	0	0	0	0	0	0	0	0
8M	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total	228.2	230.9	209.6	194.6	159.2	122.2	85.3	53.8
% Change from Previous Year		1%	(9%)	(7%)	(18%)	(23%)	(30%)	(37%)

(Continued)

MOS EPROM--Forecast

Table 2 (Continued)

Worldwide NMOS EPROM Market--Total (UV and OTP)

	Average Selling Price (\$)							
	1985	1986	1987	1988	1989	1990	1991	1992
4K	0	0	0	0	0	0	0	0
8K	0	0	0	0	0	0	0	0
16K	\$ 2.50	\$ 2.40	\$ 2.62	\$ 3.38	\$ 3.58	\$ 3.78	\$ 3.90	\$ 4.05
32K	\$ 2.41	\$ 2.32	\$ 2.77	\$ 3.47	\$ 3.75	\$ 3.95	\$ 4.07	\$ 4.10
64K	\$ 2.78	\$ 2.49	\$ 2.94	\$ 3.50	\$ 3.80	\$ 4.08	\$ 4.10	\$ 4.18
128K	\$ 3.99	\$ 2.75	\$ 3.34	\$ 3.60	\$ 3.70	\$ 3.78	\$ 3.80	\$ 3.85
256K	\$ 7.74	\$ 4.40	\$ 4.30	\$ 4.38	\$ 4.35	\$ 4.22	\$ 4.14	\$ 4.01
512K	\$32.50	\$11.73	\$ 8.05	\$ 5.85	\$ 4.80	\$ 4.32	\$ 4.20	\$ 4.08
1M	0	\$48.50	\$24.32	\$16.30	\$11.00	\$ 8.45	\$ 7.20	\$ 5.24
2M	0	0	0	0	0	0	0	0
4M	0	0	0	0	0	0	0	0
8M	0	0	0	0	0	0	0	0
Overall ASP	\$ 3.46	\$ 3.21	\$ 4.04	\$ 4.46	\$ 4.44	\$ 4.42	\$ 4.32	\$ 4.11
% Change from Previous Year		(7%)	26%	10%	0	(1%)	(2%)	(5%)

Source: Dataquest
July 1988

MOS EPROM--Forecast

Table 3

Worldwide CMOS EPROM Market--Total (UV and OTP)

	Millions of Dollars							
	1985	1986	1987	1988	1989	1990	1991	1992
4K	0	0	0	0	0	0	0	0
8K	0	0	0	0	0	0	0	0
16K	\$11	0	\$ 8	\$ 11	\$ 10	\$ 11	\$ 9	\$ 8
32K	18	\$ 7	10	9	6	3	2	2
64K	22	65	93	123	122	110	102	100
128K	4	7	41	68	71	63	59	60
256K	30	80	235	326	375	373	388	378
512K	0	4	78	149	166	170	178	185
1M	0	9	36	225	445	638	742	765
2M	0	0	0	4	25	72	264	419
4M	0	0	0	0	1	12	60	308
8M	0	0	0	0	0	0	0	5
Total	\$85	\$173	\$500	\$915	\$1,221	\$1,452	\$1,804	\$2,230

% Change from
Previous Year

105% 189% 83% 33% 19% 24% 24%

	Millions of Units							
	1985	1986	1987	1988	1989	1990	1991	1992
4K	0	0	0	0	0	0	0	0
8K	0	0	0	0	0	0	0	0
16K	3.0	0	2.4	3.3	2.7	2.7	2.1	2.0
32K	4.5	2.7	3.1	2.5	1.4	0.7	0.5	0.4
64K	5.5	17.1	25.3	31.5	29.0	25.0	22.5	21.3
128K	0.5	1.9	10.8	17.1	17.9	16.0	14.7	14.0
256K	3.2	16.2	48.0	68.6	79.8	81.9	83.5	79.6
512K	0	0.3	8.9	22.6	30.8	32.6	35.3	38.2
1M	0	0.1	1.3	13.6	38.7	71.1	100.6	116.2
2M	0	0	0	0	0.4	2.0	11.0	26.0
4M	0	0	0	0	0	0.2	1.7	15.0
8M	0	0	0	0	0	0	0	0
Total	16.7	38.3	99.8	159.1	200.6	232.2	272.0	312.6

% Change from
Previous Year

129% 161% 59% 26% 16% 17% 15%

(Continued)

MOS EPROM--Forecast

Table 3 (Continued)

Worldwide CMOS EPROM Market--Total (UV and OTP)

	Average Selling Price (\$)							
	1985	1986	1987	1988	1989	1990	1991	1992
4K	0	0	0	0	0	0	0	0
8K	0	0	0	0	0	0	0	0
16K	\$ 3.50	0	\$ 3.36	\$ 3.42	\$ 3.76	\$ 3.95	\$ 4.04	\$ 4.12
32K	\$ 4.10	\$ 2.71	\$ 3.08	\$ 3.58	\$ 3.95	\$ 4.10	\$ 4.16	\$ 4.20
64K	\$ 4.07	\$ 3.80	\$ 3.68	\$ 3.90	\$ 4.20	\$ 4.42	\$ 4.55	\$ 4.70
128K	\$ 7.20	\$ 3.89	\$ 3.80	\$ 4.00	\$ 3.98	\$ 3.94	\$ 3.99	\$ 4.30
256K	\$ 9.25	\$ 4.93	\$ 4.90	\$ 4.75	\$ 4.70	\$ 4.55	\$ 4.65	\$ 4.75
512K	\$ 30.00	\$13.95	\$ 8.68	\$ 6.58	\$ 5.40	\$ 5.20	\$ 5.05	\$ 4.85
1M	\$125.00	\$62.62	\$27.36	\$ 16.55	\$ 11.49	\$ 8.98	\$ 7.38	\$ 6.59
2M	0	0	0	\$110.00	\$ 62.00	\$36.00	\$24.00	\$ 16.10
4M	0	0	0	0	\$125.00	\$62.00	\$35.00	\$ 20.50
8M	0	0	0	0	0	0	0	\$135.00
Overall ASP	\$ 5.06	\$ 4.52	\$ 5.01	\$ 5.75	\$ 6.08	\$ 6.25	\$ 6.63	\$ 7.13
% Change from Previous Year			11%	15%	6%	3%	6%	8%

Source: Dataquest
July 1988

MOS EPROM--Forecast

Table 4

Worldwide MOS UV EPROM Market--Total (NMOS and CMOS)

	Millions of Dollars							
	1985	1986	1987	1988	1989	1990	1991	1992
4K	0	0	0	0	0	0	0	0
8K	0	0	0	0	0	0	0	0
16K	\$ 64	\$ 35	\$ 28	\$ 23	\$ 18	\$ 15	\$ 12	\$ 11
32K	96	46	46	35	21	10	6	3
64K	284	257	210	206	180	152	125	113
128K	223	150	176	184	155	118	95	92
256K	174	272	476	570	564	493	481	439
512K	14	68	242	343	305	270	230	196
1M	0	12	43	242	442	573	588	550
2M	0	0	0	4	25	71	264	426
4M	0	0	0	0	1	12	60	308
8M	0	0	0	0	0	0	0	5
Total	\$856	\$841	\$1,221	\$1,606	\$1,711	\$1,713	\$1,861	\$2,144

% Change from Previous Year	(2%)	45%	32%	7%	0%	9%	15%
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	Millions of Units							
	1985	1986	1987	1988	1989	1990	1991	1992
4K	0	0	0	0	0	0	0	0
8K	0	0	0	0	0	0	0	0
16K	24.6	14.7	9.8	6.8	4.9	3.8	3.1	2.6
32K	35.6	20.7	16.4	9.9	5.4	2.4	1.5	0.8
64K	99.0	93.9	63.8	55.0	44.0	35.0	28.0	24.5
128K	55.3	52.2	49.1	48.0	40.0	30.0	24.0	22.0
256K	21.7	57.5	102.1	121.0	116.0	103.0	98.0	86.0
512K	4	5.7	29.1	54.0	56.0	51.0	44.2	38.0
1M	0	2	1.6	14.0	38.0	61.0	72.0	76.0
2M	0	0	0	0	4	2.0	11.0	26.0
4M	0	0	0	0	0	0.2	1.7	15.0
8M	0	0	0	0	0	0	0	0
Total	236.7	244.9	271.8	308.8	304.7	288.4	283.5	290.9

% Change from Previous Year	3%	11%	14%	(1%)	(5%)	(2%)	3%
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(Continued)

MOS EPROM--Forecast

Table 4 (Continued)

Worldwide MOS UV EPROM Market--Total (NMOS and CMOS)

	Average Selling Price (\$)							
	<u>1985</u>	<u>1986</u>	<u>1987</u>	<u>1988</u>	<u>1989</u>	<u>1990</u>	<u>1991</u>	<u>1992</u>
4K	0	0	0	0	0	0	0	0
8K	0	0	0	0	0	0	0	0
16K	\$ 2.60	\$ 2.40	\$ 2.80	\$ 3.40	\$ 3.68	\$ 3.90	\$ 4.00	\$ 4.10
32K	\$ 2.71	\$ 2.24	\$ 2.83	\$ 3.50	\$ 3.80	\$ 4.00	\$ 4.10	\$ 4.15
64K	\$ 2.87	\$ 2.74	\$ 3.29	\$ 3.74	\$ 4.10	\$ 4.34	\$ 4.47	\$ 4.63
128K	\$ 4.03	\$ 2.88	\$ 3.59	\$ 3.84	\$ 3.88	\$ 3.92	\$ 3.97	\$ 4.19
256K	\$ 8.02	\$ 4.73	\$ 4.66	\$ 4.71	\$ 4.86	\$ 4.79	\$ 4.91	\$ 5.11
512K	\$32.50	\$11.94	\$ 8.33	\$ 6.35	\$ 5.44	\$ 5.29	\$ 5.20	\$ 5.15
1M	0	\$58.57	\$26.77	\$ 17.29	\$ 11.62	\$ 9.39	\$ 8.16	\$ 7.24
2M	0	0	0	\$110.00	\$ 62.00	\$36.00	\$24.00	\$ 16.40
4M	0	0	0	0	\$125.00	\$62.00	\$35.00	\$ 20.50
8M	0	0	0	0	0	0	0	\$135.00
Overall ASP	\$ 3.62	\$ 3.43	\$ 4.49	\$ 5.20	\$ 5.61	\$ 5.94	\$ 6.56	\$ 7.37
% Change from Previous Year		(5%)	31%	16%	8%	6%	10%	12%

Source: Dataquest
July 1988

MOS EPROM--Forecast

Table 5

Worldwide NMOS UV Market

	Millions of Dollars							
	1985	1986	1987	1988	1989	1990	1991	1992
4K	0	0	0	0	0	0	0	0
8K	0	0	0	0	0	0	0	0
16K	\$ 54	\$ 35	\$ 19	\$ 12	\$ 8	\$ 4	\$ 4	\$ 2
32K	78	39	37	26	15	7	4	2
64K	265	193	120	87	61	43	24	14
128K	219	143	136	118	86	56	38	33
256K	144	202	254	253	182	106	74	37
512K	14	63	165	196	136	97	47	1
1M	0	3	8	40	60	71	50	34
2M	0	0	0	0	0	0	0	0
4M	0	0	0	0	0	0	0	0
8M	0	0	0	0	0	0	0	0
Total	\$774	\$679	\$739	\$731	\$548	\$384	\$241	\$122
% Change from Previous Year		(12%)	9%	(1%)	(25%)	(30%)	(37%)	(49%)

	Millions of Units							
	1985	1986	1987	1988	1989	1990	1991	1992
4K	0	0	0	0	0	0	0	0
8K	0	0	0	0	0	0	0	0
16K	21.6	14.7	7.4	3.5	2.2	1.1	1.0	0.6
32K	31.1	18.1	13.3	7.4	4.0	1.7	1.0	0.4
64K	94.5	77.6	39.9	24.6	15.6	10.4	5.7	3.3
128K	54.8	50.3	38.7	31.4	22.7	14.4	9.6	8.2
256K	18.5	43.4	57.1	55.6	39.5	23.4	16.3	8.0
512K	0.4	5.4	20.2	31.6	25.5	18.8	9.2	0.1
1M	0	0.1	0.3	2.4	5.3	7.9	6.4	4.8
2M	0	0	0	0	0	0	0	0
4M	0	0	0	0	0	0	0	0
8M	0	0	0	0	0	0	0	0
Total	220.9	209.5	176.9	156.6	114.8	77.7	49.2	25.4
% Change from Previous Year		(5%)	(16%)	(11%)	(27%)	(32%)	(37%)	(48%)

(Continued)

MOS EPROM--Forecast

Table 5 (Continued)

Worldwide NMOS UV Market

	Average Selling Price (\$)							
	1985	1986	1987	1988	1989	1990	1991	1992
4K	0	0	0	0	0	0	0	0
8K	0	0	0	0	0	0	0	0
16K	\$ 2.48	\$ 2.40	\$ 2.62	\$ 3.38	\$ 3.58	\$3.78	\$3.90	\$4.05
32K	\$ 2.51	\$ 2.17	\$ 2.77	\$ 3.47	\$ 3.75	\$3.95	\$4.07	\$4.10
64K	\$ 2.80	\$ 2.49	\$ 3.00	\$ 3.54	\$ 3.92	\$4.14	\$4.15	\$4.18
128K	\$ 4.00	\$ 2.84	\$ 3.52	\$ 3.75	\$ 3.80	\$3.90	\$3.95	\$4.00
256K	\$ 7.80	\$ 4.65	\$ 4.45	\$ 4.54	\$ 4.62	\$4.52	\$4.55	\$4.60
512K	\$32.50	\$11.82	\$ 8.18	\$ 6.18	\$ 5.32	\$5.18	\$5.12	\$5.08
1M	0	\$48.50	\$24.32	\$16.80	\$11.28	\$9.00	\$7.78	\$7.02
2M	0	0	0	0	0	0	0	0
4M	0	0	0	0	0	0	0	0
8M	0	0	0	0	0	0	0	0
Total	\$ 3.50	\$ 3.24	\$ 4.18	\$ 4.67	\$ 4.77	\$4.95	\$4.89	\$4.80
% Change from Previous Year		(8%)	29%	12%	2%	4%	(1%)	(2%)

Source: Dataquest
July 1988

MOS EPROM--Forecast

Table 6

Worldwide CMOS UV EPROM Market

	Millions of Dollars							
	1985	1986	1987	1988	1989	1990	1991	1992
4K	0	0	0	0	0	0	0	0
8K	0	0	0	0	0	0	0	0
16K	\$10	0	\$ 8	\$ 11	\$ 10	\$ 11	\$ 9	\$ 8
32K	18	\$ 7	10	9	6	3	2	2
64K	19	63	90	118	119	109	101	100
128K	4	7	40	67	69	61	57	60
256K	30	70	222	317	382	388	407	402
512K	0	4	77	147	169	173	182	195
1M	0	9	36	202	382	502	538	516
2M	0	0	0	4	25	71	264	426
4M	0	0	0	0	1	12	60	308
8M	0	0	0	0	0	0	0	5
Total	\$82	\$162	\$482	\$875	\$1,163	\$1,329	\$1,620	\$2,022
% Change from Previous Year		98%	198%	82%	33%	14%	22%	25%

	Millions of Units							
	1985	1986	1987	1988	1989	1990	1991	1992
4K	0	0	0	0	0	0	0	0
8K	0	0	0	0	0	0	0	0
16K	3.0	0	2.4	3.3	2.7	2.7	2.1	2.0
32K	4.5	2.7	3.1	2.5	1.4	0.7	0.5	0.4
64K	4.5	16.3	23.9	30.4	28.4	24.6	22.3	21.2
128K	0.5	1.9	10.4	16.7	17.3	15.6	14.4	13.9
256K	3.2	14.1	45.0	65.4	76.5	79.6	81.7	78.0
512K	0	0.3	8.9	22.4	30.5	32.3	35.0	37.9
1M	0	0.1	1.3	11.6	32.7	53.1	65.6	71.2
2M	0	0	0	0	0.4	2.0	11.0	26.0
4M	0	0	0	0	0	0.2	1.7	15.0
8M	0	0	0	0	0	0	0	0
Total	15.7	35.4	95.0	152.1	189.9	210.7	234.3	265.5
% Change from Previous Year		125%	168%	60%	25%	11%	11%	13%

(Continued)

MOS EPROM--Forecast

Table 6 (Continued)

Worldwide CMOS UV EPROM Market

	Average Selling Price (\$)							
	1985	1986	1987	1988	1989	1990	1991	1992
4K	0	0	0	0	0	0	0	0
8K	0	0	0	0	0	0	0	0
16K	\$3.50	0	\$ 3.36	\$ 3.42	\$ 3.76	\$ 3.95	\$ 4.04	\$ 4.12
32K	\$4.10	\$ 2.71	\$ 3.08	\$ 3.58	\$ 3.95	\$ 4.10	\$ 4.16	\$ 4.20
64K	\$4.25	\$ 3.87	\$ 3.78	\$ 3.90	\$ 4.20	\$ 4.42	\$ 4.55	\$ 4.70
128K	\$7.20	\$ 3.94	\$ 3.83	\$ 4.00	\$ 3.98	\$ 3.94	\$ 3.99	\$ 4.30
256K	\$9.25	\$ 4.98	\$ 4.93	\$ 4.85	\$ 4.99	\$ 4.87	\$ 4.98	\$ 5.16
512K	0	\$14.08	\$ 8.68	\$ 6.58	\$ 5.54	\$ 5.35	\$ 5.22	\$ 5.15
1M	0	\$62.62	\$27.35	\$ 17.39	\$ 11.68	\$ 9.45	\$ 8.20	\$ 7.25
2M	0	0	0	\$110.00	\$ 62.00	\$36.00	\$24.00	\$ 16.40
4M	0	0	0	0	\$125.00	\$62.00	\$35.00	\$ 20.50
8M	0	0	0	0	0	0	0	\$135.00
Overall ASP	\$5.18	\$ 4.57	\$ 5.08	\$ 5.75	\$ 6.12	\$ 6.31	\$ 6.92	\$ 7.61
% Change from Previous Year		(12%)	11%	13%	6%	3%	10%	10%

Source: Dataquest
July 1988

MOS EPROM--Forecast

Table 7

Total MOS OTP EPROM Market--Total (NMOS and CMOS)

	Millions of Dollars							
	1985	1986	1987	1988	1989	1990	1991	1992
4K	0	0	0	0	0	0	0	0
8K	0	0	0	0	0	0	0	0
16K	0	0	0	0	0	0	0	0
32K	\$ 5	\$ 1	0	0	0	0	0	0
64K	10	12	\$ 23	\$ 23	\$ 17	\$ 12	\$ 6	\$ 2
128K	3	12	25	28	35	26	20	10
256K	3	46	65	69	79	80	61	54
512K	0	0	14	35	45	51	49	41
1M	0	0	0	21	46	111	175	201
2M	0	0	0	0	0	0	0	0
4M	0	0	0	0	0	0	0	0
Total	\$20	\$72	\$126	\$177	\$222	\$279	\$311	\$307
% Change from Previous Year	(3%)	259%	76%	40%	26%	26%	11%	(1%)

	Millions of Units							
	1985	1986	1987	1988	1989	1990	1991	1992
4K	0	0	0	0	0	0	0	0
8K	0	0	0	0	0	0	0	0
16K	0	0	0	0	0	0	0	0
32K	3.0	0.9	0	0	0	0	0	0
64K	4.0	5.7	9.4	8.0	6.0	4.0	2.0	0.5
128K	0.8	5.2	8.6	9.0	11.0	8.0	6.0	3.0
256K	0.5	12.5	17.9	19.0	21.5	23.0	18.0	16.0
512K	0	0	1.8	7.0	11.0	13.0	12.8	11.0
1M	0	0	0	2.0	6.0	18.0	35.0	45.0
2M	0	0	0	0	0	0	0	0
4M	0	0	0	0	0	0	0	0
Total	8.3	24.2	37.7	45.0	55.5	66.0	73.8	75.5

(Continued)

MOS EPROM--Forecast

Table 7 (Continued)

Total MOS OTP EPROM Market—Total (NMOS and CMOS)

	<u>Average Selling Price (\$)</u>							
	<u>1985</u>	<u>1986</u>	<u>1987</u>	<u>1988</u>	<u>1989</u>	<u>1990</u>	<u>1991</u>	<u>1992</u>
4K	0	0	0	0	0	0	0	0
8K	0	0	0	0	0	0	0	0
16K	0	0	0	0	0	0	0	0
32K	\$1.50	\$ 1.75	0	0	0	0	0	0
64K	\$2.46	\$ 2.01	\$2.47	\$ 2.90	\$2.89	\$3.09	\$3.23	\$3.26
128K	\$3.50	\$ 2.27	\$2.87	\$ 3.11	\$3.17	\$3.22	\$3.26	\$3.34
256K	\$5.50	\$ 3.73	\$3.63	\$ 3.63	\$3.69	\$3.46	\$3.41	\$3.36
512K	0	\$10.19	\$7.54	\$ 5.02	\$4.06	\$3.91	\$3.80	\$3.75
1M	0	0	0	\$10.66	\$7.60	\$6.14	\$4.99	\$4.46
2M	0	0	0	0	0	0	0	0
4M	0	0	0	0	0	0	0	0
Overall ASP	\$2.40	\$ 2.95	\$3.35	\$ 3.92	\$4.00	\$4.23	\$4.21	\$4.07

Source: Dataquest
July 1988

MOS EPROM--Forecast

Table 8

Worldwide NMOS OTP EPROM Market

	Millions of Dollars							
	1985	1986	1987	1988	1989	1990	1991	1992
4K	0	0	0	0	0	0	0	0
8K	0	0	0	0	0	0	0	0
16K	0	0	0	0	0	0	0	0
32K	\$ 5	\$ 1	0	0	0	0	0	0
64K	7	10	\$ 19	\$ 20	\$ 15	\$ 11	\$ 6	\$ 2
128K	3	12	24	26	33	24	18	9
256K	3	38	53	57	67	71	55	48
512K	0	0	13	34	43	49	47	40
1M	0	0	0	0	0	0	0	0
2M	0	0	0	0	0	0	0	0
4M	0	0	0	0	0	0	0	0
Total	\$17	\$61	\$108	\$137	\$159	\$156	\$127	\$99
% Change from Previous Year	(19%)	266%	78%	26%	16%	(2%)	(19%)	(22%)

	Millions of Units							
	1985	1986	1987	1988	1989	1990	1991	1992
4K	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
8K	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
16K	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
32K	3.0	0.9	0	0	0	0	0	0
64K	3.0	4.9	8.0	6.9	5.4	3.6	1.8	0.5
128K	0.8	5.2	8.2	8.6	10.5	7.6	5.7	2.9
256K	0.5	10.4	14.8	15.8	18.3	20.7	16.2	14.4
512K	N/A	0	1.8	6.8	10.7	12.6	12.4	10.7
1M	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2M	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
4M	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total	7.3	21.4	32.8	38.0	44.8	44.5	36.1	28.4

N/A = Not Available

(Continued)

MOS EPROM--Forecast

Table 8 (Continued)

Worldwide NMOS OTP EPROM Market

	Average Selling Price (\$)							
	1985	1986	1987	1988	1989	1990	1991	1992
4K	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
8K	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
16K	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
32K	\$1.50	\$ 1.75	0	0	0	0	0	0
64K	\$2.20	\$ 1.96	\$2.40	\$2.87	\$2.85	\$3.07	\$3.22	\$3.26
128K	\$3.50	\$ 2.27	\$2.86	\$3.09	\$3.15	\$3.20	\$3.24	\$3.32
256K	\$5.50	\$ 3.63	\$3.55	\$3.59	\$3.68	\$3.44	\$3.40	\$3.35
512K	N/A	\$10.00	\$7.53	\$5.00	\$4.05	\$3.90	\$3.80	\$3.75
1M	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2M	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
4M	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Overall ASP	\$2.28	\$ 2.85	\$3.31	\$3.60	\$3.54	\$3.50	\$3.50	\$3.50

N/A = Not Available

Source: Dataquest
July 1988

MOS EPROM--Forecast

Table 9

Worldwide CMOS OTP EPROM Market

	<u>Millions of Dollars</u>							
	<u>1985</u>	<u>1986</u>	<u>1987</u>	<u>1988</u>	<u>1989</u>	<u>1990</u>	<u>1991</u>	<u>1992</u>
4K	0	0	0	0	0	0	0	0
8K	0	0	0	0	0	0	0	0
16K	0	0	0	0	0	0	0	0
32K	0	0	0	0	0	0	0	0
64K	\$3	\$ 2	\$ 4	\$ 3	\$ 2	\$ 1	\$ 1	0
128K	0	0	1	2	2	1	1	\$ 1
256K	0	9	12	12	12	8	6	6
512K	0	0	0	1	1	2	1	1
1M	0	0	0	21	46	111	175	201
2M	0	0	0	0	0	0	0	0
4M	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total	\$3	\$11	\$18	\$40	\$63	\$123	\$184	\$208
% Change from Previous Year		228%	67%	124%	58%	96%	49%	13%

	<u>Millions of Units</u>							
	<u>1985</u>	<u>1986</u>	<u>1987</u>	<u>1988</u>	<u>1989</u>	<u>1990</u>	<u>1991</u>	<u>1992</u>
4K	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
8K	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
16K	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
32K	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
64K	1.0	0.8	1.4	1.1	0.6	0.4	0.2	0
128K	N/A	0	0.4	0.5	0.6	0.4	0.3	0.2
256K	N/A	2.1	3.1	3.2	3.2	2.3	1.8	1.6
512K	N/A	0	0.1	0.2	0.3	0.4	0.4	0.3
1M	N/A	0	0	2.0	6.0	18.0	35.0	45.0
2M	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
4M	<u>N/A</u>	<u>N/A</u>	<u>N/A</u>	<u>N/A</u>	<u>N/A</u>	<u>N/A</u>	<u>N/A</u>	<u>N/A</u>
Total	1.0	2.9	4.9	7.0	10.7	21.5	37.7	47.1

N/A = Not Available

(Continued)

MOS EPROM--Forecast

Table 9 (Continued)

Worldwide CMOS OTP EPROM Market

	Average Selling Price (\$)							
	1985	1986	1987	1988	1989	1990	1991	1992
4K	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
8K	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
16K	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
32K	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
64K	\$3.25	\$ 2.35	\$2.84	\$ 3.10	\$3.27	\$3.30	\$3.32	\$3.34
128K	\$5.00	\$ 2.89	\$3.04	\$ 3.50	\$3.55	\$3.58	\$3.61	\$3.62
256K	\$8.50	\$ 4.22	\$3.99	\$ 3.80	\$3.75	\$3.65	\$3.54	\$3.46
512K	N/A	\$11.30	\$7.90	\$ 5.50	\$4.40	\$4.10	\$3.90	\$3.80
1M	N/A	N/A	N/A	\$10.66	\$7.60	\$6.14	\$4.99	\$4.46
2M	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
4M	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Overall ASP	\$3.25	\$ 3.71	\$3.63	\$ 5.68	\$5.89	\$5.74	\$4.89	\$4.42

N/A = Not Available

Source: Dataquest
July 1988

MOS EPROM--Forecast

The Market—1987

Worldwide MOS EPROM revenue totaled \$1.347 billion in 1987, posting a significant 48 percent growth in revenue over the 1986 total of \$913 million. Of the 27 known EPROM suppliers, Intel had an estimated 20 percent share of that market, followed, but not closely, by Fujitsu with a 12 percent share. While unit shipments increased 15 percent to 309.5 million in 1987, over the 269.1 million units shipped in 1986, technology shifts from NMOS to CMOS and higher average selling prices (ASPs), accounted for the most notable changes in EPROMs in 1987.

Comparison with Earlier Forecasts

The current EPROM forecast reflects several significant differences from the version published in April 1987. The changes and reasons for these differences are as follows:

- Actual revenue, unit shipments, and ASPs for 1986 have been adjusted to reflect final numbers completed by the middle of 1987.
- Actual bit shipments increased 71 percent as a result of significant growth in the 256K, 512K, and 1-Mbit densities.
- Overall ASPs increased 28 percent in 1987, rounding out at \$4.35, compared with \$3.39 in 1986. Higher EPROM prices are a direct result of MITI's imposed reduction of EPROM shipments to the United States by Japanese suppliers.
- The NMOS share of EPROMs tumbled to 68 percent of all EPROM units shipped in 1987, down from its pedestal of 86 percent share of units in 1986. Increased demand for CMOS, a reduction in price premium between CMOS and NMOS, and a switch over to CMOS by more suppliers/users are strong indicators of a growing CMOS market.
- The U.S. manufacturers' share of the EPROM market increased, reaching 44.5 percent in 1987, while the Japanese manufacturers' share dropped to 47.4 percent, down from 55.5 percent in the previous year.
- Shipments of low-density, high-speed CMOS EPROMs increased substantially in 1987. As a result, we have increased the unit forecasts and extended the life cycles of the 16K and 64K EPROMs.

MOS EPROM--Forecast

Market Outlook

Although the second quarter of 1987 saw EPROM prices firming, pushing revenue out of the depressed price market of 1986, a large portion of the 1987 EPROM revenue growth can be attributed to trade agreement pressures. As a result of further U.S.-Japan trade agreement discussions, MITI introduced production cutback guidelines for memory suppliers. By the second quarter of 1987, cutbacks on Japanese memory exports and restrictions on export licenses slowed the flow of EPROM products to the United States. After suffering through two years of overcapacity, depressed prices, and nonexistent margins, U.S. EPROM manufacturers reaped the benefits of MITI's production reductions. Second-quarter increased user demands and supplier capacity constraints forced onshore companies to look for excess capacity, and users to face longer lead times and higher prices. Beset by MITI's monitoring and capacity constraints on DRAMs, offshore manufacturers such as Hitachi, NEC, Oki, and Toshiba, slowed and/or stopped production of their 64K, 128K, and 256K EPROMs, and focused production on their more value-added DRAM products. As DRAM capacity improves, we expect these manufacturers to jump back into the EPROM arena.

High-Speed EPROMs

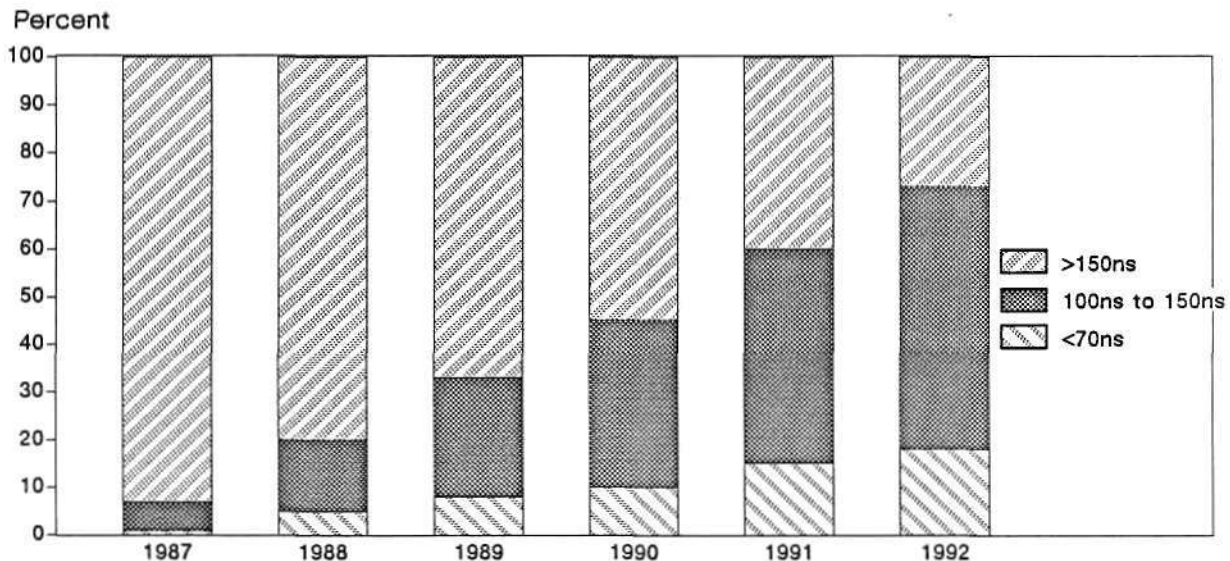
Several key developments occurred in high-speed EPROM products in 1987. ICT, Goldstar, and Mitsubishi joined the ranks of high-speed EPROM suppliers. While Goldstar is still in the R&D stage with its 30ns 64K device, ICT began sampling its 8Kx8 device with access times ranging from 40 to 55ns. However, Mitsubishi is stalking the high-density area with a 120ns 256K device and 512K devices accessing 125ns and 150ns speeds. WaferScale Integration is producing a 35ns 8Kx8 device, and has also introduced 16Kx16 and 32Kx8 256K devices that can achieve 55ns.

Figure 6 illustrates Dataquest's preliminary estimate of the high-speed EPROM market as a percent of total units sold. The very high-speed, less than 70ns product category with speeds averaging 35ns to 55ns, will be driven by the low 8K, 16K, and 64K devices. These low-density, high-speed products are geared for very specific bipolar PROM replacement applications. The greater than 70ns, or high-speed category, specifically the 100ns to 150ns range, will be driven by high-performance microprocessor and DSP applications. We expect the 100ns to 150ns range to be the most prevalent EPROM speed range by 1992. While the 64K and 256K densities will sustain the largest growth for high-speed and very high-speed demand in 1988, increased growth in the larger 512K and above densities is expected by 1989.

MOS EPROM--Forecast

Figure 6

High-Speed EPROM Market Speeds (Percent of Units)



Source: Dataquest
July 1988

CMOS/NMOS EPROMs

CMOS EPROM units grew an unexpected 161 percent in 1987 over 1986. CMOS represented a 32 percent share of total EPROM units in 1987, compared with its 14 percent unit share in 1986. As such, we expect the CMOS share to represent 45 percent of total unit shares in 1988, and surpass NMOS with a 56 percent share of units by 1989. Key developments in fast programming time, fast access time, low power dissipation, and higher productivity have made CMOS increasingly competitive with NMOS. While CMOS EPROMs continue to command a price premium over NMOS, the price differentials have shrunk to a level where users are now willing to pay for high performance.

MOS UV/OTP EPROMs

Table 4 (MOS UV EPROMs) deals with EPROMs packaged in UV erasable packages, while Table 7 deals strictly with production of one-time programmable (OTP) EPROMs in plastic packages without windows.

MOS EPROM--Forecast

Dataquest has consistently made the packaging distinction between EPROMs in the UV erasable packages and those in nonerasable plastic packages (OTPs) for the primary reason of separately tracking an anticipated shift to less-expensive packages. Our forecast for 1987 through 1992 shows that UV EPROMs will continue to have a higher fraction of the EPROM market. Growth in the OTP arena will continue, but at a slower pace than expected. We expect that Intel, Mitsubishi, and Toshiba will continue to be the major suppliers supporting a very focused product application market. We expect that principal end-user demand will be in the 256K, 512K, and 1-Mbit densities. As the Flash memory market develops, we expect further decline in the growth and development of the OTP, especially in the higher 1-Mbit and above densities. The OTP EPROM has faltered in gaining acceptance as a viable technology. Its reputation is permeated with black marks and obstacles, including questionable reliability, manufacturer inability to support product with second sourcing, declining EPROM prices, and poor customer acceptance. The OTP area is ripe for an attack from the Flash, with its low-cost, windowless package, high-performance speeds, and rapid bulk erase and reprogrammability.

Flash Memory

Flash memory technology was first introduced by Toshiba with its announcement of the 256K Flash EEPROM in 1985. The emerging Flash technology is now being supported by Intel, National, and Seeq, with potential entries in the next twelve months from AMD, Hitachi, Microchip Technologies, Inc., and Texas Instrument. It is a nonvolatile memory that implements an EPROM-like process and design approach. Flash memory requires a 12V power supply for programming and erasing, and employs electron tunneling for bulk erase. Typical erase time is 1 second to erase the entire memory. Total reprogrammability and bulk erase time is less than a minute, compared with the typical 15 to 20 minutes for UVEPROMs. If there are no unforeseen technical obstacles, Dataquest believes that Flash memory, like other new and emerging memory technologies, shows great promise in enhancing the nonvolatile memory market.

At present, Flash memories are at sampling and/or low volume production stages. Fueled by the right market forces—competition, general economic conditions, supply/demand dynamics—Flash should proceed along the learning curve and capture a sizable share of the nonvolatile memory market.

We expect shipments of the recently introduced 64K, 256K, and 512K Flash products to ramp up in the latter part of 1988, while introduction of the 1-Mbit device is assumed in 1989.

Short-Term Forecast

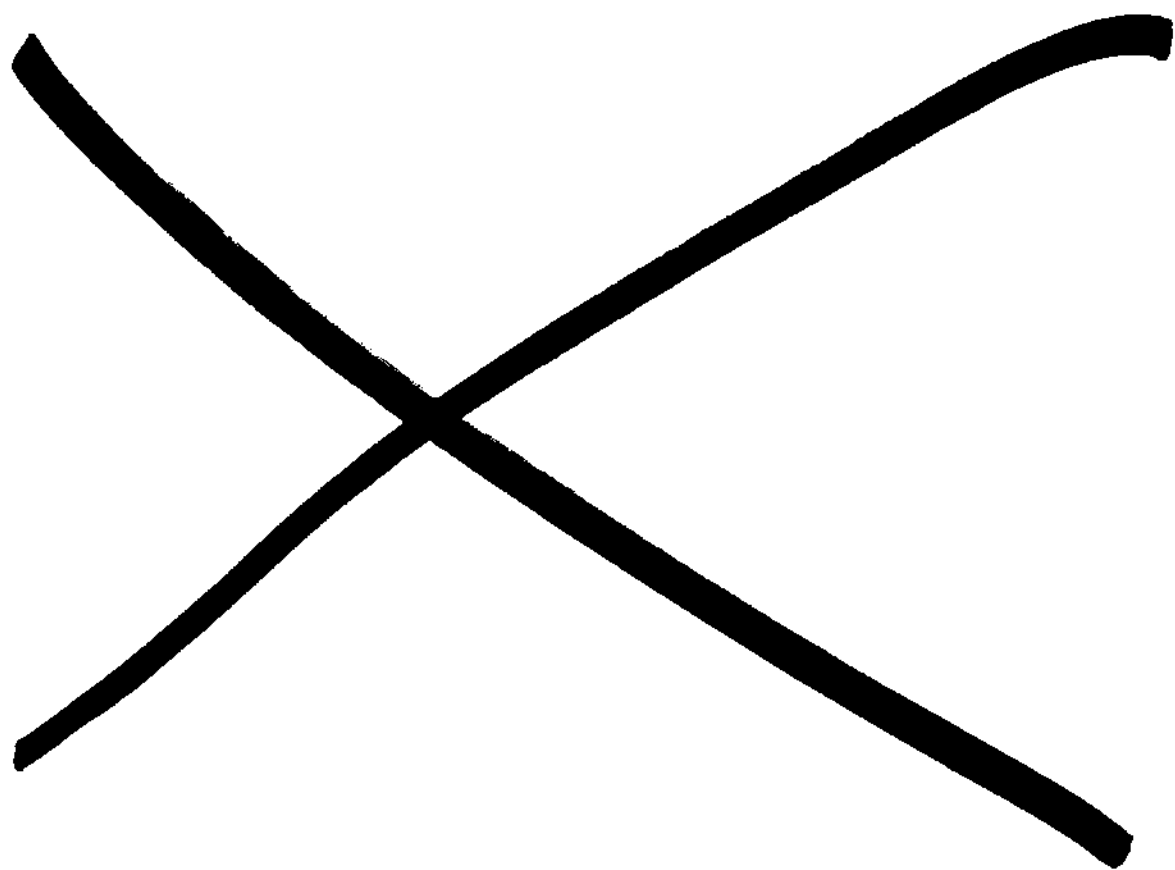
Dataquest believes that EPROM market developments will follow those of the DRAM market closely. While EPROM availability will not be as constrained as DRAMs, prices will remain high through the end of 1988. Although 1-Mbit EPROM unit shipments reached 1.611 million in 1987, with Japanese vendors capturing more than 75 percent of market share, 1-Mbit unit shipments fell far below our forecast of 5.7 million units. On a more optimistic note, new entrants and user emphasis on high speed, could boost 1-Mbit shipments to 16 million units by the end of 1988.

MOS EPROM--Forecast

Long-Term Forecast

Bit growth will continue to be slow from 1987 through 1990, with an upturn expected in 1991. Bit growth is expected to have a compound annual growth rate (CAGR) of 37.3 percent from 1987 through 1992. The major driving forces behind bit growth will come from the automotive and computer sectors. More EPROMs are expected to be used in the computer as operating systems become more complex and feature filled, and as communications and multitasking functions become more prevalent. We expect the bit share of the transportation sector to expand in 1991, and become the largest sector, displacing consumer applications.

We believe that Toshiba's announcement of its 120ns 4-Mbit EPROM, along with the high-speed CMOS developments in 1987 and the innovative Flash memory announcements of 1987 and early 1988, were precursors of strong growth for the EPROM market. At present, the EPROM market is a commodity market fraught with too many suppliers sharing too little revenue. The outlook for EPROMs will be bright only for those suppliers that can maintain a full range of innovative products that cover a variety of speeds, and thus withstand the continued onslaught from offshore competition.



MOS EPROM--Product Life Cycles

OVERVIEW OF PRODUCT LIFE CYCLES

Understanding product life cycles can be an important element of a company's strategic planning. How well semiconductor manufacturers and users implement product life cycles may well determine their strength and future direction against worldwide competition.

The objectives of this section are to discuss the changes taking place in MOS EPROM life cycles and to determine what new directions and strategies are being implemented by EPROM manufacturers and users worldwide. Analysis of product life cycles offers many advantages to manufacturers, including the following:

- The ability to identify specific market segments over the product's life cycle
- The ability to recognize technical opportunities for product innovation
- The ability to determine whether the timing of their entry and departure maximizes their revenues and profits
- The ability to evaluate the strength of their product portfolios

Analysis of product life cycles also offers many advantages to users, including the following:

- The ability to make new design decisions
- The ability to develop a commodity plan for purchasing and design engineering that maximizes availability of vital components and minimizes cost
- The ability to control and/or alter the product life cycle, given a thorough understanding of its behavior

THE MOS EPROM PRODUCT LIFE CYCLES

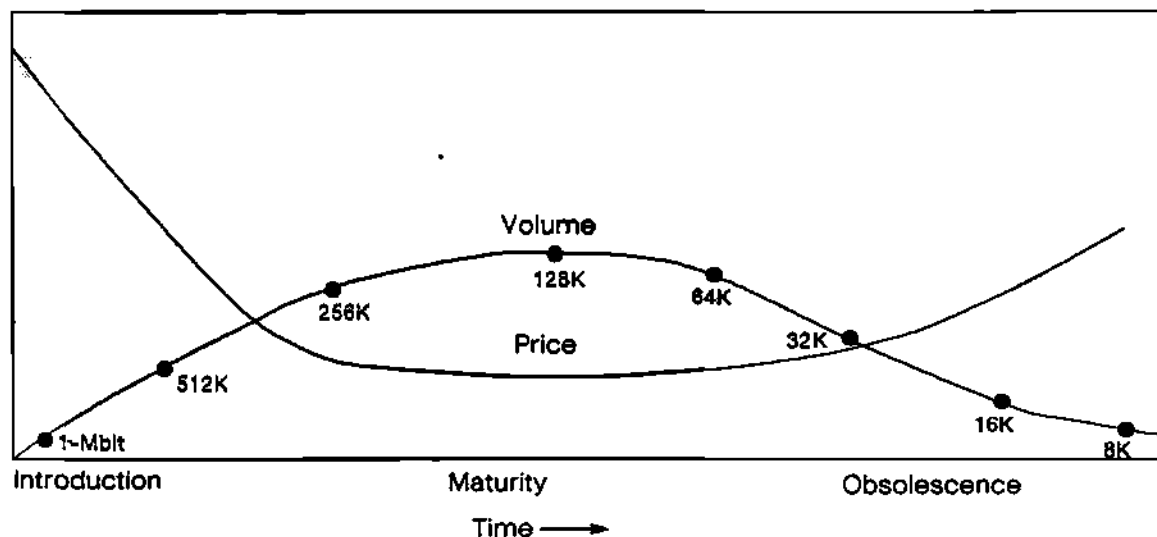
Figure 1 illustrates the stage of each group of EPROM devices in a standard product life cycle and the typical interval of each stage. Product price is normally high during the product introduction stage. Because of the high cost of development, the manufacturer does not begin to realize profits from the device until well into the growth phase of the product's life. Once volume production levels are reached and manufacturing efficiency occurs, economies of scale go into effect and prices decline. Typically, prices decline at a faster rate for newer products than for older products that have reached the mature stage of the product life cycle.

MOS EPROM--Product Life Cycles

Figure 1

TYPICAL IC PRODUCT LIFE CYCLES

Price or Volume



Source: Dataquest
April 1987

The life cycle of a device and of the equipment into which it is being designed should always be compared. Selecting a device in its decline phase may force the equipment manufacturer to pay a premium price for an obsolete product, or to make a lifetime buy of that part. At the other end of the life cycle, the risk of designing in an untried product must be weighed against the technical advantages offered by the new device.

Although the majority of MOS EPROMs have maintained extended life cycles, it is not unusual for an IC product to be introduced, to mature, and then to become obsolete in three years. This accelerated life cycle can adversely affect the market position of the semiconductor user's end product. The best protection against this occurrence is for the user to work with the suppliers to anticipate the next one or two generations of product evolution. This procedure allows the next generation of semiconductor devices to be incorporated into the final product by means of minimal engineering changes.

MOS EPROM--Product Life Cycles

Historically, lower densities tend to linger in the decline stage several years because of the long life of the system using them. For example, the 2K EPROM, originally introduced to the market in 1972, was not phased out until 1983. The 8K EPROM maintained a similar life cycle. Introduced in 1975, it did not reach its phaseout stage until late 1985.

It is interesting to note that although several manufacturers began shipping new 256K and 512K densities in 1984, market growth resulted from increased unit shipments of the more mature devices--32K, 64K, and 128K devices. Tight capacity situations and a variety of technical, manufacturing, and market development problems made it very difficult for manufacturers to ship new densities and introduce new OTP and CMOS technologies.

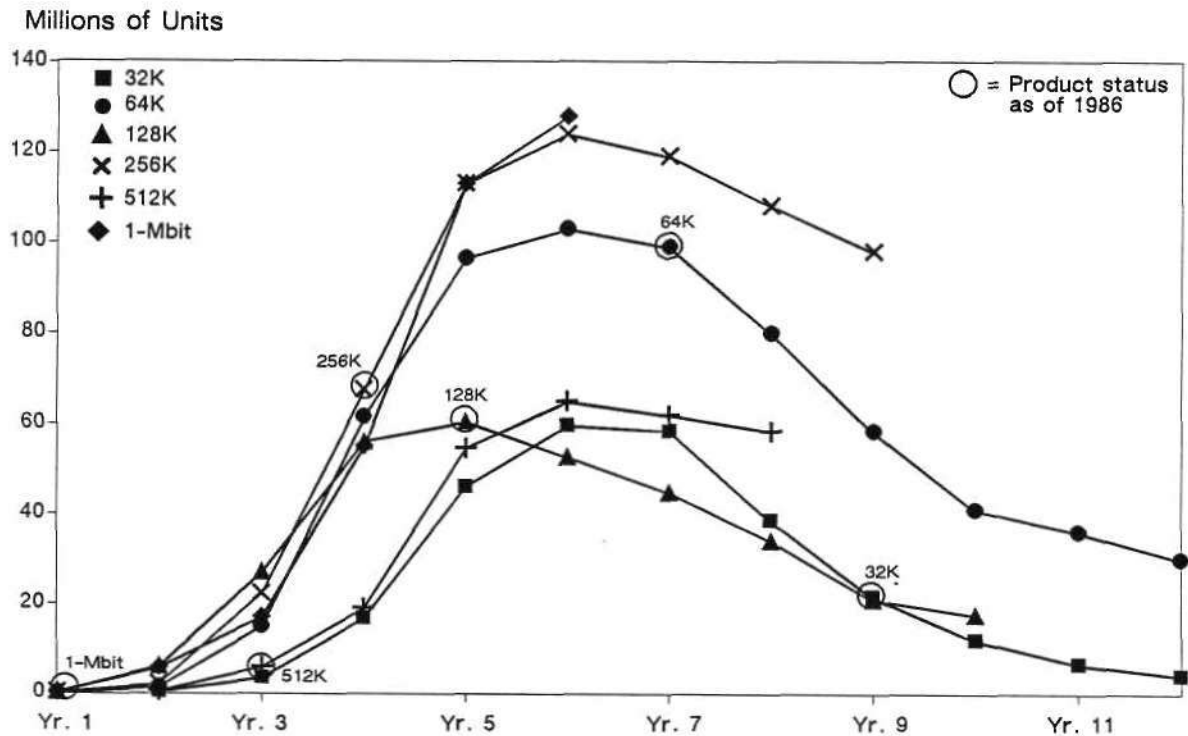
The Product Life Cycles by Density

The actual life cycle curves for EPROMs and how they vary by density are shown in Figure 2. Traditionally, the lower-density EPROMs peaked during their sixth year of production. Anomalies do occur, however. Dataquest believes that the 128K EPROM peaked in 1986, during its fifth year of production. We believe that package differences between the 32K and the 128K are causing resistance to upgrade. The 32K has a 24-pin configuration, while the 128K has a 28-pin configuration. Both products are compatible with the 12-MHz 8051 product. To move to the 128K at this time will necessitate a board redesign, which users are not likely to shoulder for their mature systems. For this reason, we expect the 32K life cycle to linger in its decline stage, with users upgrading eventually to the 512K in 1988. We expect the 256K EPROM to peak in 1988 but then to maintain a gradual decline very similar to that of the 64K density.

MOS EPROM--Product Life Cycles

Figure 2

MOS EPROM PRODUCT LIFE CYCLES BY DENSITY



Source: Dataquest
April 1987

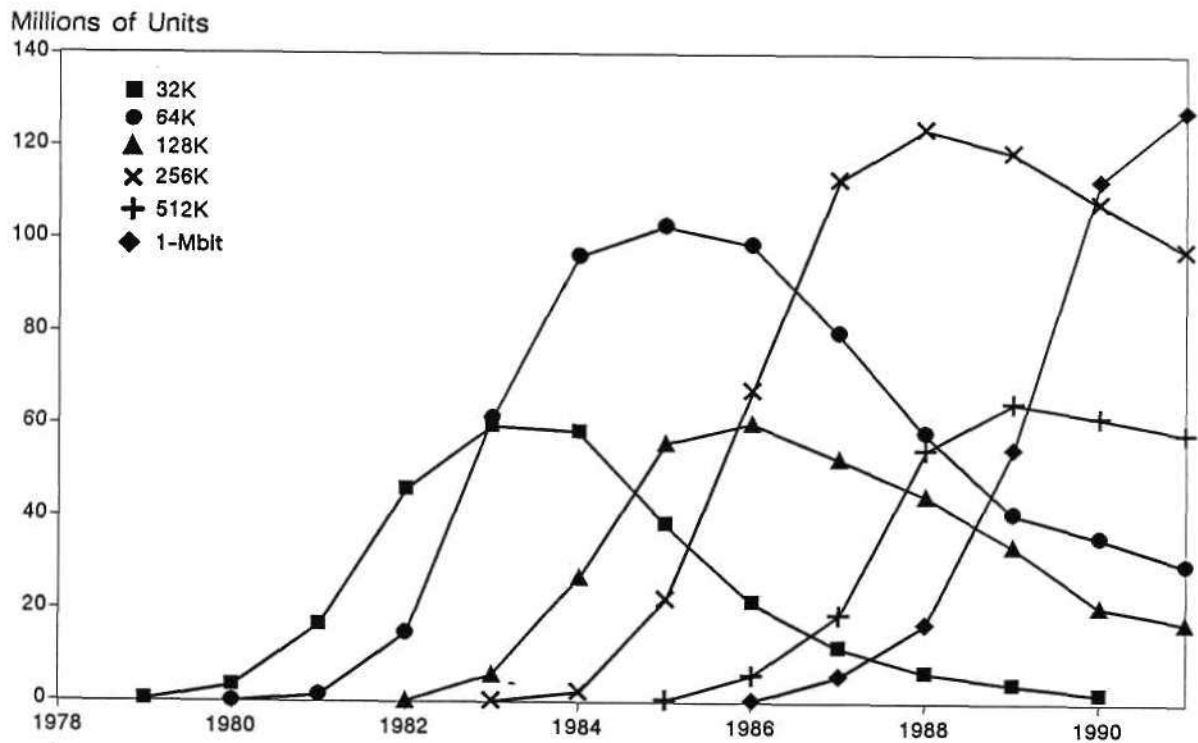
The Product Life Cycles through Time

The forecasted behavior of each density through time is illustrated in Figure 3. The historical two-year interval between density introduction changed with the 256K EPROM. The 256K was introduced in 1983, one year after the 128K. This was followed closely by the 512K in 1984, and the 1-Mbit EPROM in 1985. User acceptance of the 1-Mbit products is expected to be delayed until the 1989 time frame.

MOS EPROM--Product Life Cycles

Figure 3

MOS EPROM PRODUCT LIFE CYCLES THROUGH TIME



Source: Dataquest
April 1987

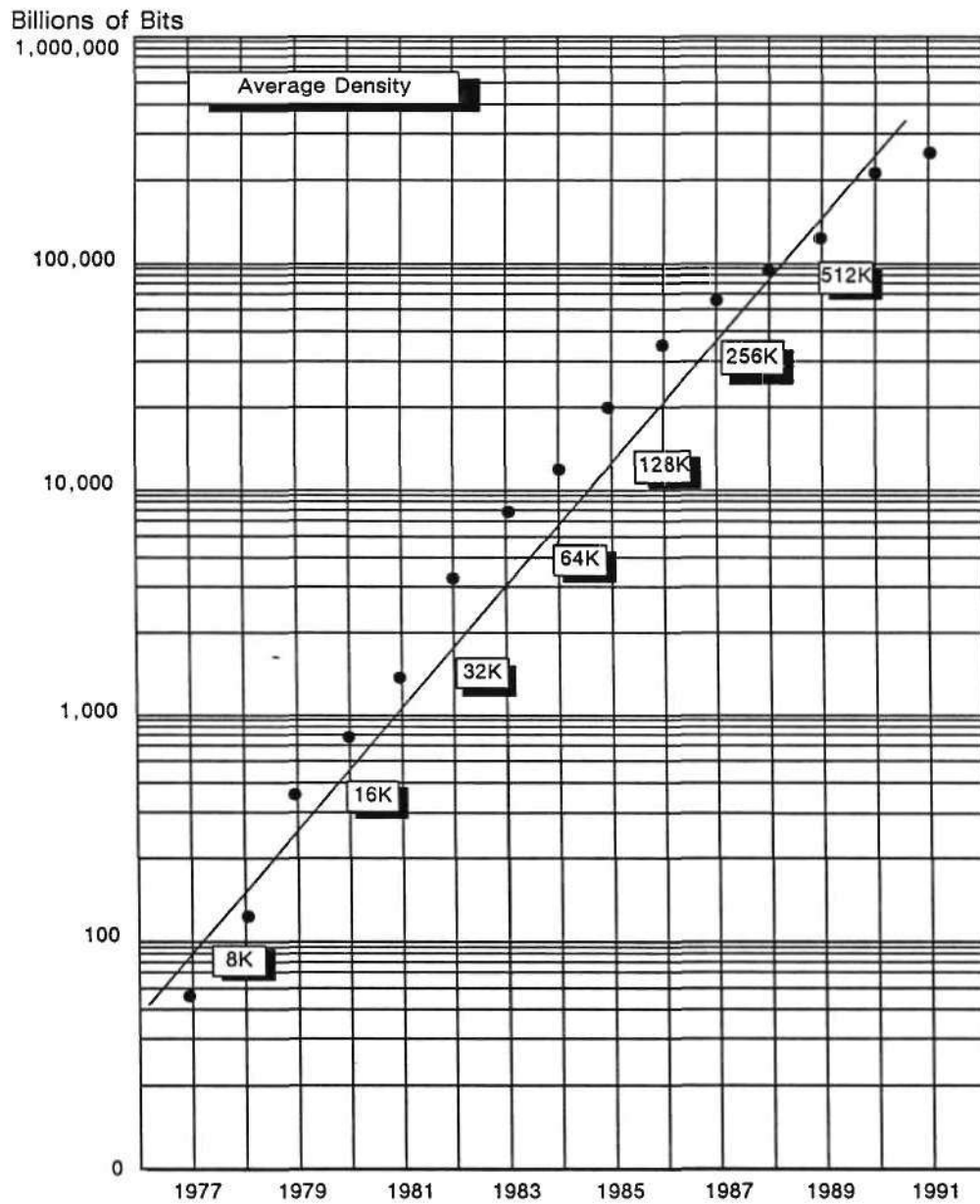
BIT-GROWTH ANALYSIS

Bit growth, as shown in Figure 4, is the actual and projected growth of the entire EPROM product line from 1977 through 1991. Although we expect bit growth to continue at a fairly steady pace from 1987 through 1991, we do not expect it to maintain the 100 to 200 percent per year growth trend that occurred in the EPROM heyday from early 1977 through 1983.

MOS EPROM--Product Life Cycles

Figure 4

ESTIMATED MOS EPROM BIT GROWTH



MOS EPROM--Product Life Cycles

We have reduced our estimate of the long-term growth rate for total bits shipped. Our estimated bit consumption from 1987 through 1991 reflects a slowdown in the market penetration of CMOS, the emergence of newer technologies (such as OTP in EPROMs), and user reluctance to jump headlong into the 1-Mbit market.

MOS EPROM--Product Life Cycles

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THE MOS EPROM PRODUCT LIFE CYCLES

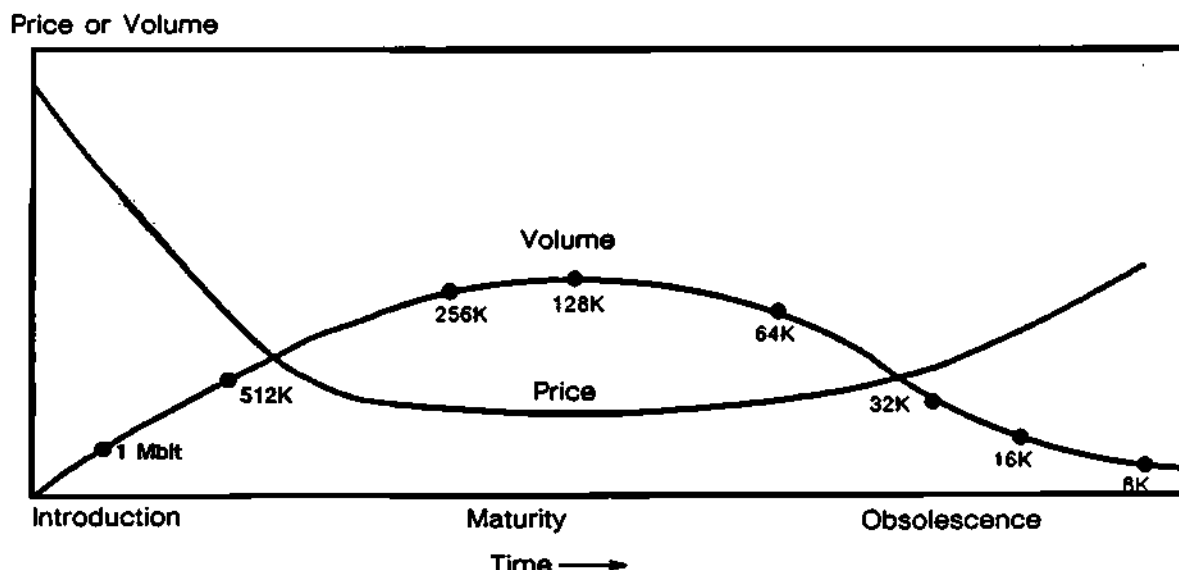
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MOS EPROM--Product Life Cycles

Figure 1

Typical IC Product Life Cycles



Source: Dataquest
June 1988

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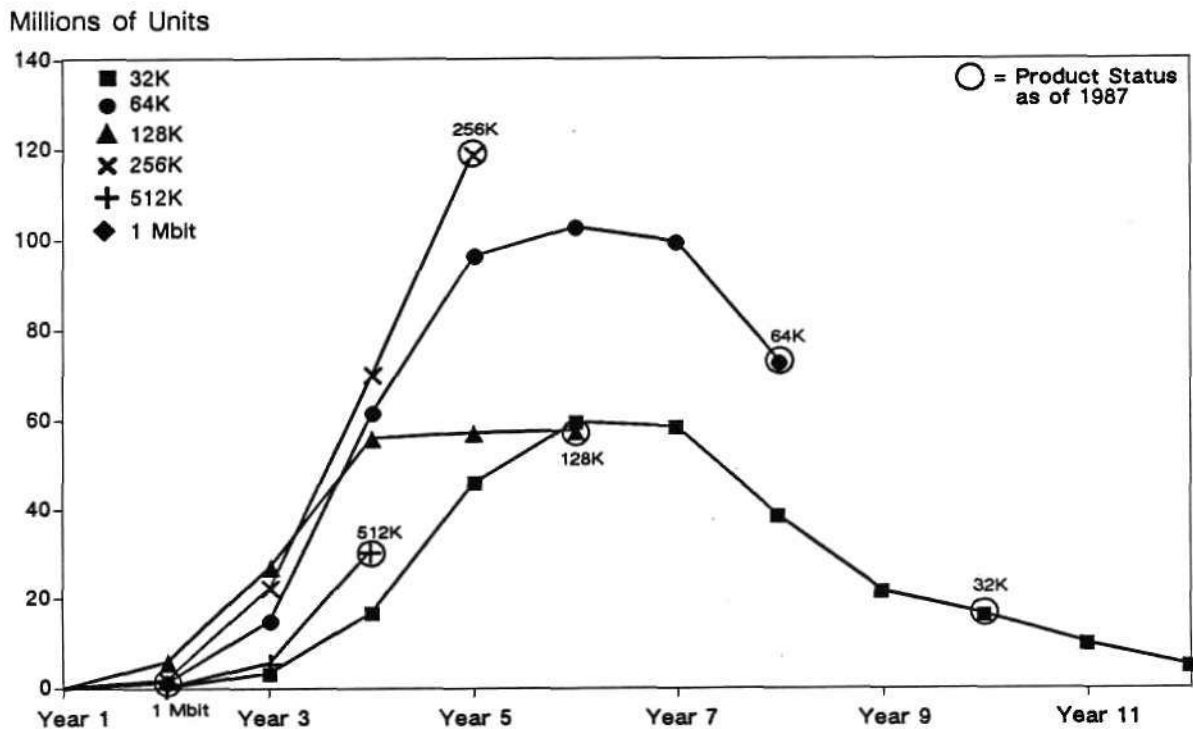
MOS EPROM--Product Life Cycles

Product Life Cycles by Density

The actual life cycle curves for EPROMs and how they vary by density are shown in Figure 2. Traditionally, the lower-density EPROMs peaked during their sixth year of production. However, anomalies do occur. Although Dataquest had expected the 128K to peak in 1986, during its fifth year of production, unit shipments actually increased slightly above our expectations, reaching 57.7 million units, above the 57.3 million units of 1986. The growth of the 128K density has been slow in comparison with other EPROM densities. We believe that package differences between the 32K and the 128K caused user resistance to upgrade. The 32K has a 24-pin configuration, whereas the 128K has a 28-pin configuration. Both products are compatible with the 12-MHz 8051 product. To move to the 128K would necessitate a board redesign, which users would not shoulder for their mature systems. Although the 128K continued to grow in its sixth year, user upgrade to the 512K in 1987 was phenomenal, growing beyond our expectations. We expect the growth of the 512K to follow the traditional life cycle and peak during its sixth year in 1989. The growth patterns of the 256K are very similar to those of the 64K density. As such, we expect the 256K to peak in 1988, but then to maintain a very gradual decline very similar to that of the 64K density.

Figure 2

MOS EPROM Product Life Cycles by Density



Source: Dataquest
June 1988

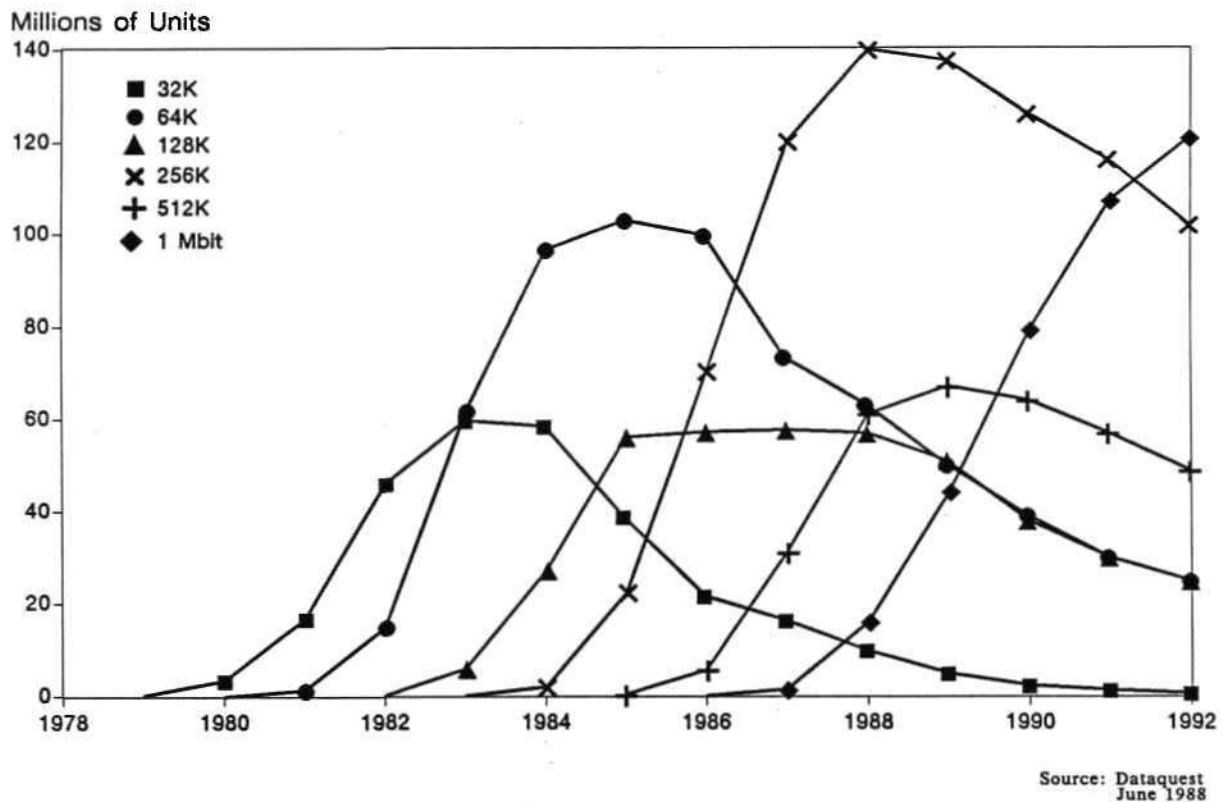
MOS EPROM--Product Life Cycles

The Product Life Cycles through Time

The forecasted behavior of each density through time is illustrated in Figure 3. The historical two-year interval between density introduction changed with the 256K EPROM. The 256K was introduced in 1983, one year after the 128K. This was followed closely by the 512K in 1984, and the 1-Mbit EPROM in 1985. User acceptance of the 1-Mbit products is expected to be delayed until the 1989 time frame.

Figure 3

MOS EPROM Product Life Cycles Through Time



MOS EPROM--Product Life Cycles

BIT-GROWTH ANALYSIS

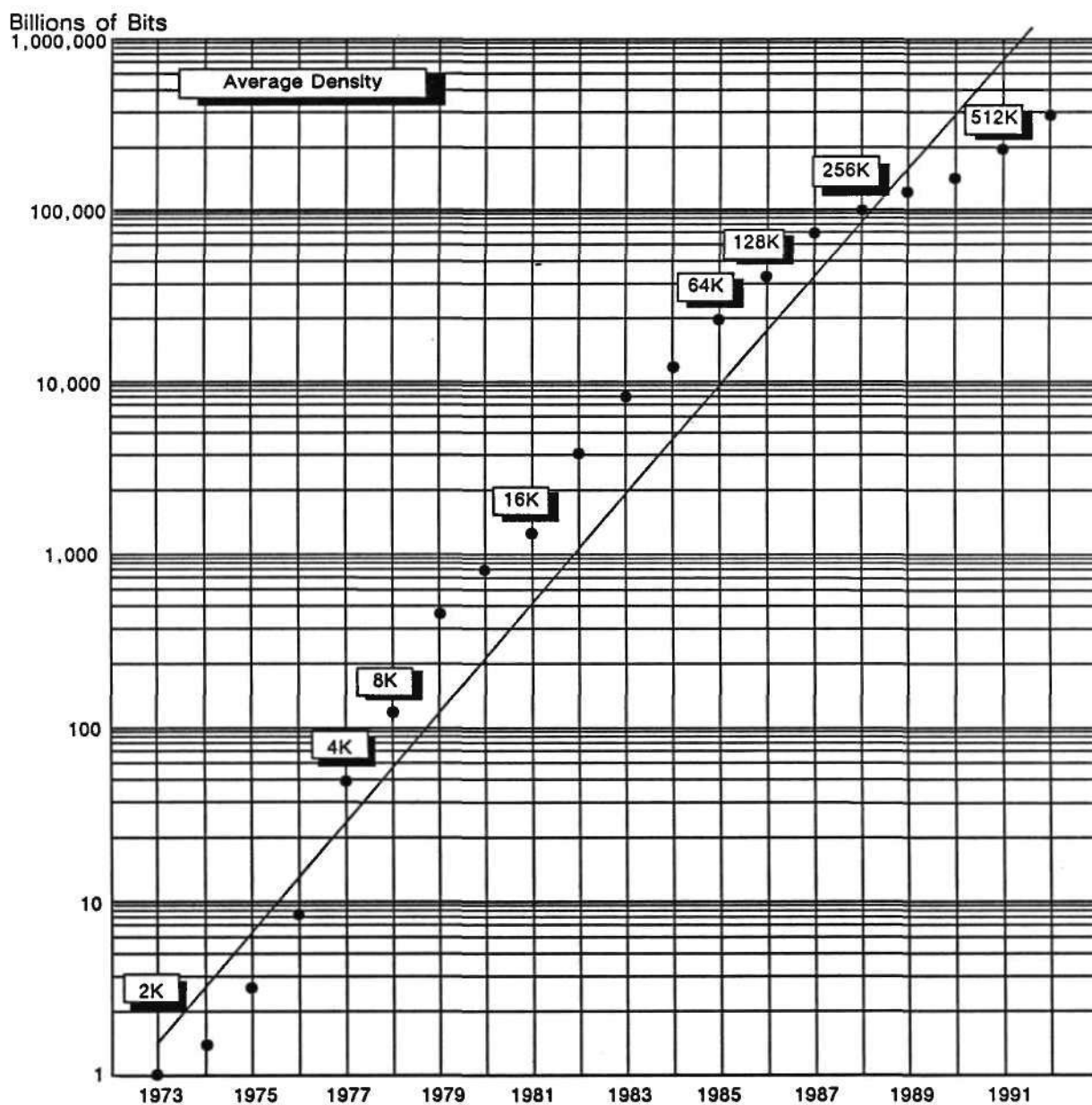
Figure 4 illustrates the actual and projected bit growth of the entire EPROM product line from 1973 through 1992. Although bit growth continues at a moderate pace from mid-1986 through 1988, after a two-year slowdown from late 1984 through early 1986, it is not expected to maintain the 100 to 200 percent per year growth that occurred in the EPROM heyday from early 1977 through 1983.

Consistent with our 1987 bit-growth forecast, we are projecting a reduction in the long-term growth rate of total bits shipped. The compound annual growth rate (CAGR) for EPROM bit consumption in North America, from 1986 to 1991, is expected to be 54 percent, a slightly faster growth rate than the worldwide bit consumption of 48.7 percent. However, worldwide and, more importantly, United States-based manufacturing of major electronic equipment is projected to grow at a slower pace from 1987 through 1991. This implies a slower-growing market for semiconductor memories and, as a result, a slowdown in bit growth. The largest end-use segments for EPROMs are those that are heavy users of microcontrollers—transportation, consumer, and computer storage. The share of EPROM bits will change by 1990 from the 1986 and 1987 time frame. Consumer systems will be replaced by transportation. The transportation market in North America is expected to be the largest consumer of EPROM bits by 1991. As the focus moves toward new applications and high-volume markets in 1991 that require denser 1-Mbit, 2-Mbit, and 4-Mbit EPROMs, bit growth will improve substantially, moving upward during the late 1992 through 1995 time frame.

MOS EPROM--Product Life Cycles

Figure 4

Estimated MOS EPROM Bit Growth



Source: Dataquest
June 1988

MOS EPROM—Product Life Cycles

OVERVIEW OF PRODUCT LIFE CYCLES

Understanding product life cycles can be an important element of a company's strategic planning. How well semiconductor manufacturers and users implement product life cycles may well determine their strength and future direction against worldwide competition.

The objectives of this section are to discuss the changes taking place in MOS EPROM life cycles and determine what new directions and strategies are being implemented by EPROM manufacturers and users worldwide. Analysis of product life cycles offers many advantages to manufacturers, including the following:

- The ability to identify specific market segments over the product's life cycle
- The ability to recognize technical opportunities for product innovation
- The ability to determine whether the timing of their entry and departure maximizes their revenue and profits
- The ability to evaluate the strength of their product portfolios

Analysis of product life cycles also offers many advantages to users, including the following:

- The ability to make new design decisions
- The ability to develop a commodity plan for purchasing and design engineering that maximizes availability of vital components and minimizes cost
- The ability to control and/or alter the product life cycle given a thorough understanding of its behavior

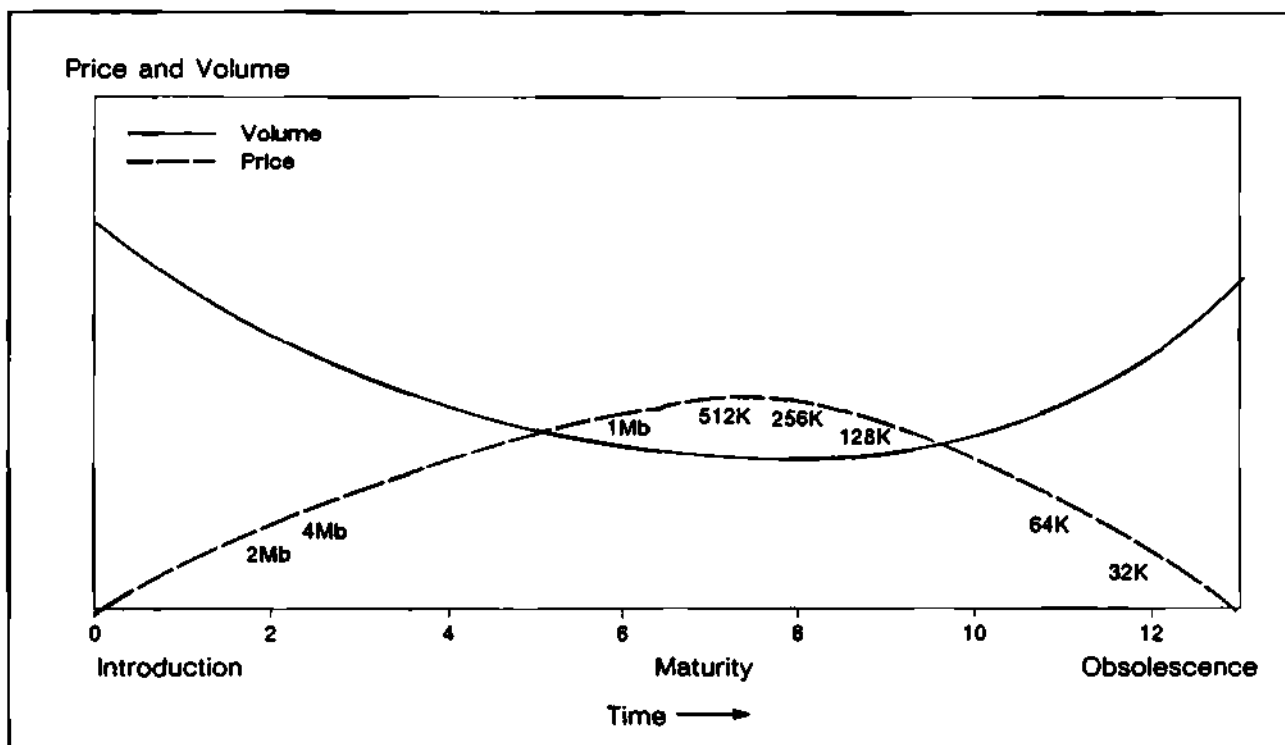
THE MOS EPROM PRODUCT LIFE CYCLES

Figure 1 illustrates the stage of each group of EPROM devices in 1990 in a standard product life cycle and the typical interval of each stage. Product price is normally high during the product introduction stage. Because of the high cost of development, the manufacturer does not begin to realize profits from the device until well into the growth phase of the product's life. Once volume production levels are reached and manufacturing efficiency occurs, economies of scale go into effect and prices decline. Typically, prices decline at a faster rate for newer products than for older products that have reached the mature stage of the product life cycle.

The life cycle of a device and of the equipment into which it is being designed should always be compared. Selecting a device in its decline phase may force the equipment manufacturer to pay a premium price for an obsolete product or make a lifetime buy of that part. At the other end of the life cycle, the risk of designing in an untried product must be weighed against the technical advantages offered by the new device.

Although the majority of MOS EPROMs have maintained extended life cycles, it is not unusual for an IC product to be introduced, mature, and then become obsolete in three years. This accelerated life cycle can adversely affect the market position of the semiconductor user's end product. The best protection against this occurrence is for the user to work with the suppliers to anticipate the next one or two generations of product evolution. This procedure allows the next generation of semiconductor devices to be incorporated into the final product by means of minimal engineering changes.

Figure 1
Typical IC Product Life Cycles



Source: Dataquest (January 1991)

Historically, lower densities tend to linger in the decline stage several years because of the long life of the system using them. For example, the 2K EPROM, originally introduced to the market in 1972, was not phased out until 1983. The 8K EPROM maintained a similar life cycle. Introduced in 1975, it did not reach its phaseout stage until late 1985.

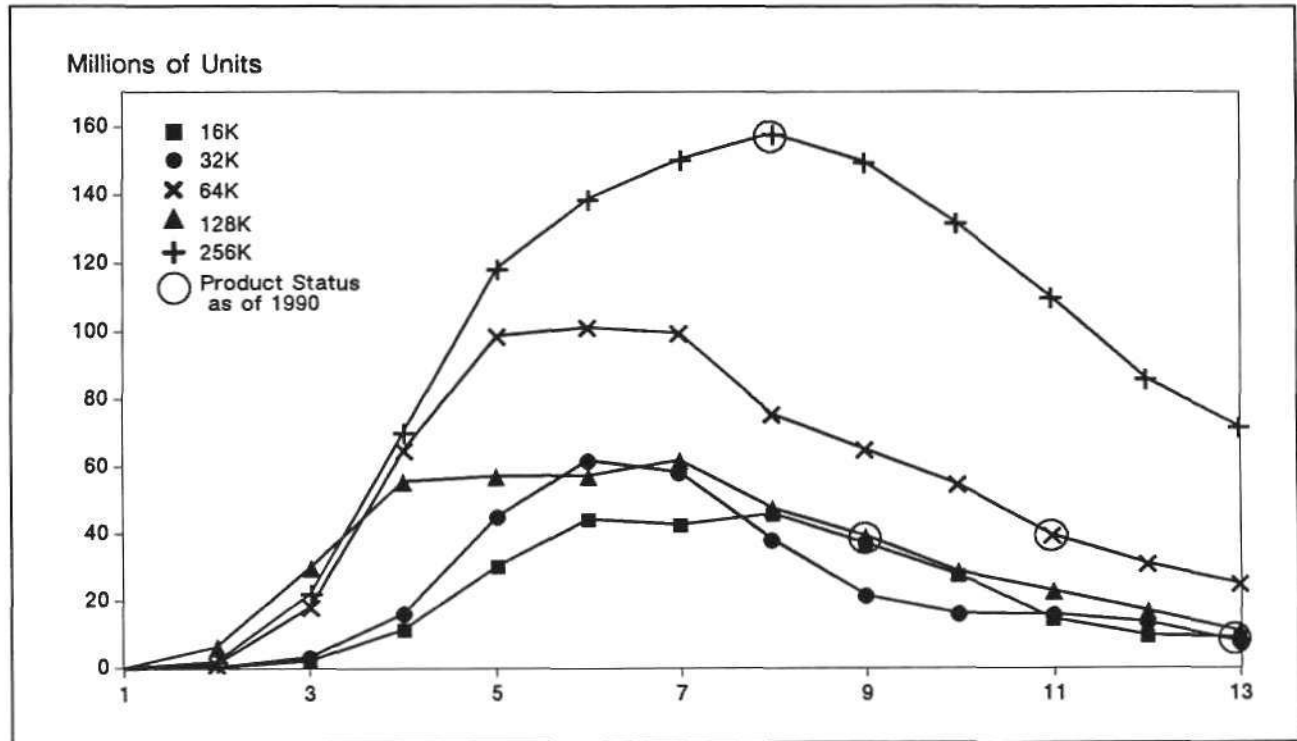
It is interesting to note that although several manufacturers began shipping new 256K and 512K densities in 1984, market growth resulted from increased unit shipments of the more mature 32K, 64K, and 128K devices. Tight capacity situations and a variety of technical, manufacturing, and market development problems made it very difficult for manufacturers to ship new densities and introduce new OTP and CMOS technologies.

Product Life Cycles by Density

The actual life cycle curves for EPROMs and how they vary by density are shown in Figures 2 and 3. Traditionally, the lower-density EPROMs peaked during their sixth year of production. However, anomalies do occur. The 128K EPROM continued to ramp in production through 1988, its seventh year of production. The production life cycles of both the 256K and 512K also are breaking away from the traditional, with peak production occurring during the seventh year. Although the initial growth patterns of the 256K were very similar to the 64K density, the 256K has exceeded market expectations in terms of production and end use. The 256K is expected to maintain a gradual decline in its life cycle, with continued end-market demand driven by speed enhancements.

Figure 2

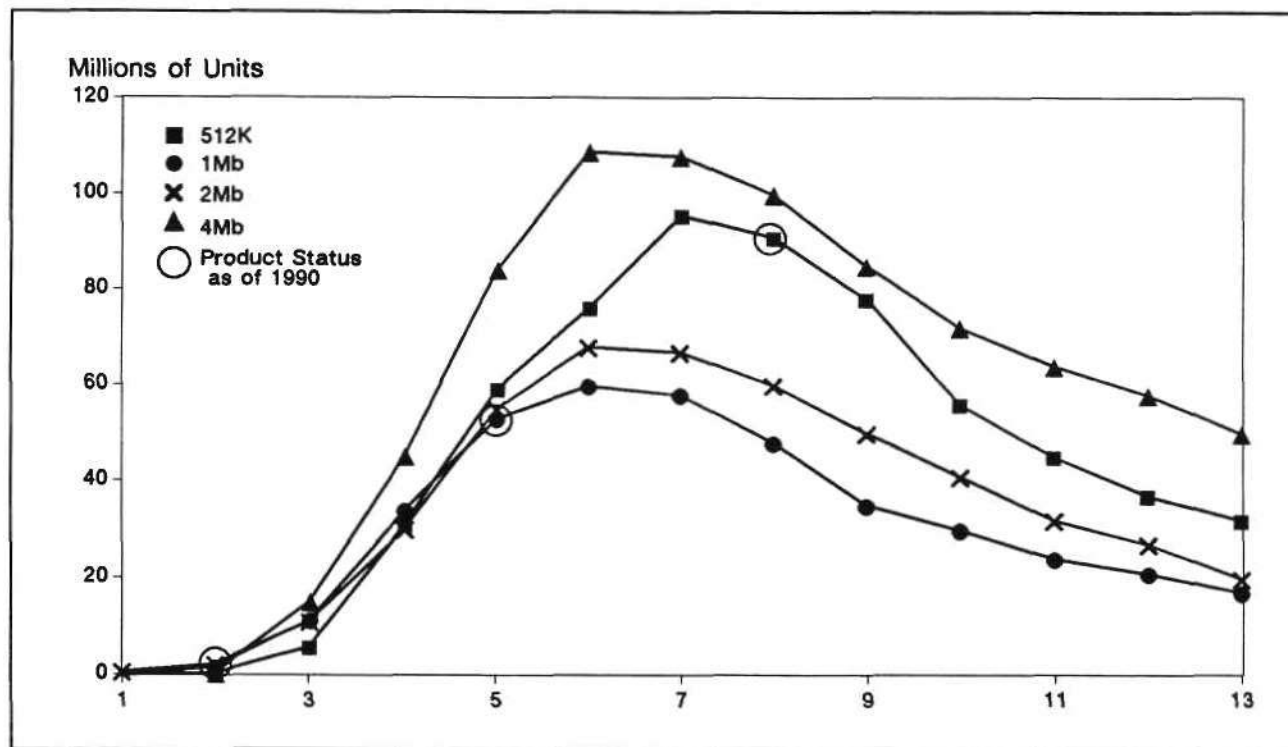
MOS EPROM Product Life Cycles by Density



Source: Dataquest (January 1991)

Figure 3

MOS EPROM Product Life Cycles by Density



Source: Dataquest (January 1991)

The Product Life Cycles through Time

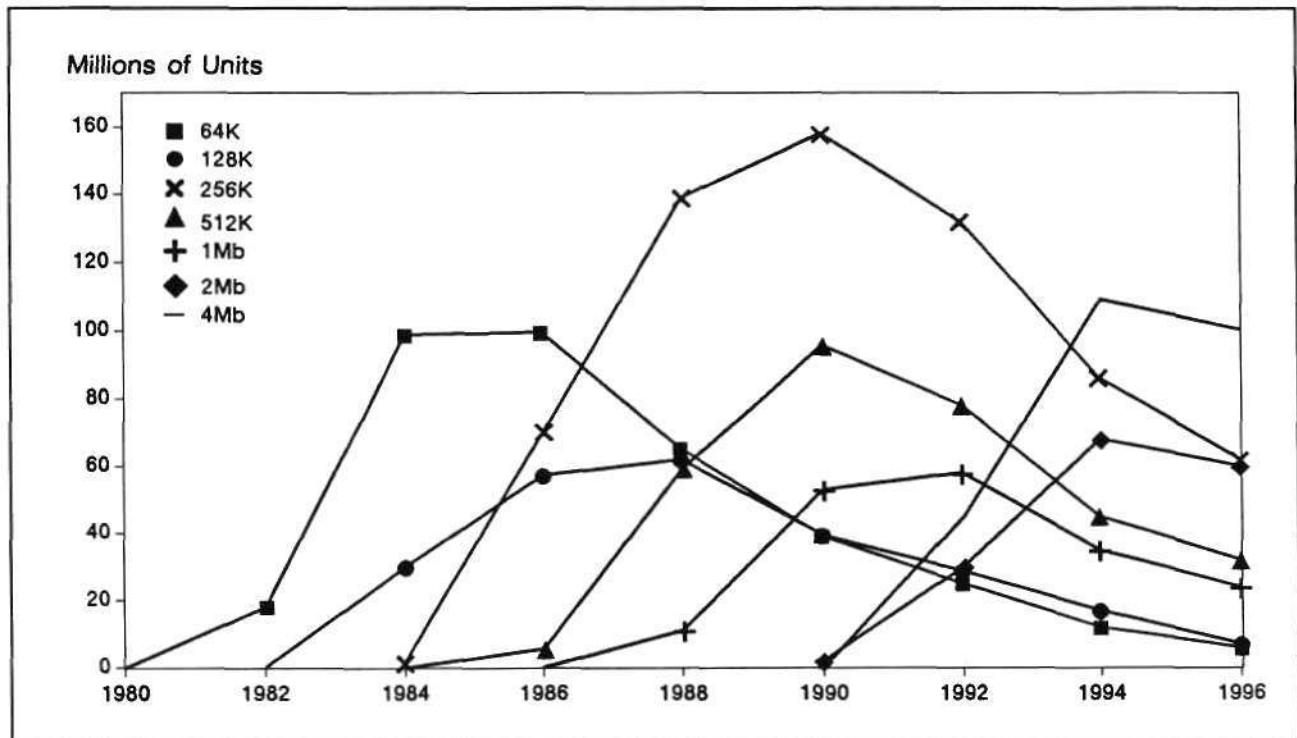
The forecast behavior of each density throughout time is illustrated in Figure 4. The historical two-year interval between density introduction changed with the 256K EPROM. The 256K was introduced in 1983, one year after the 128K and was followed by the 512K in 1984 and the 1Mb EPROM in 1985. Production of the 2Mb and the 4Mb began in 1989.

BIT-GROWTH ANALYSIS

Figure 5 illustrates the actual and projected bit growth of the entire EPROM product line from 1973 through 1996. Consistent with Dataquest's 1987 and 1988 bit-growth forecasts, we are projecting a reduction in the long-term growth rate of total bits shipped. Worldwide manufacturing of major electronic equipment is expected to have a compound annual growth rate (CAGR) of 8 percent from 1990 through 1995. The CAGR for the North American electronic equipment market is expected to be 6 percent during that same time frame. The transportation, consumer, and computer storage segments are expected to continue to be the largest end users of EPROM bits through 1991, with bit growth declining through the 1992 through 1995 time frame.

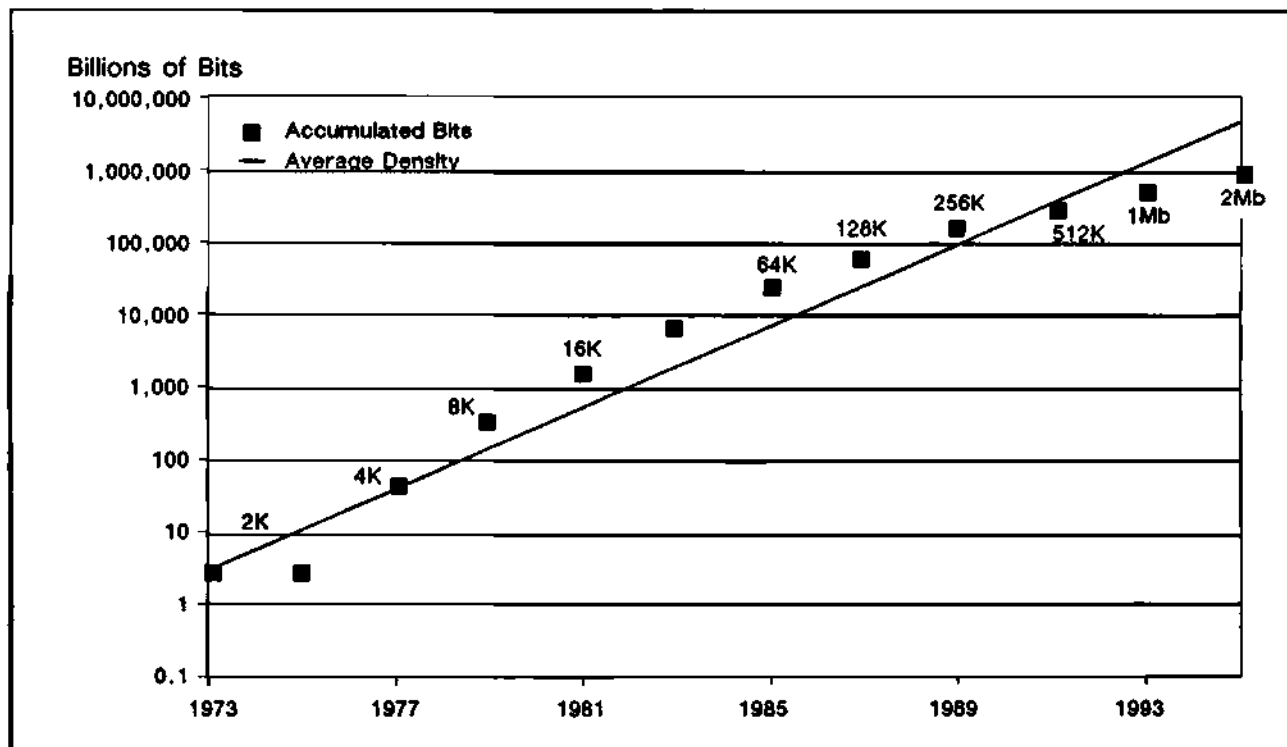
Figure 4

MOS EPROM Product Life Cycles Through Time



Source: Dataquest (January 1991)

Figure 5
Estimated MOS EPROM Bit Growth



Source: Dataquest (January 1991)

CONTACT REPORT

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- 07 Consulting

Client Contact

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DISCUSSION: _____

ACTION: _____

MOS EPROM--Price Learning Curves

OVERVIEW OF PRICE LEARNING CURVES

Applying learning curves to MOS EPROM product prices can be a strategic tool for long-range business planning and analysis. Unlike cost experience curves, price curves are heavily influenced by extraneous market forces such as competition, substitute technology, general economic conditions, and/or supply and demand dynamics. The experience curve concept was developed by the Boston Consulting Group in the late 1960s. The concept is based on historical studies showing that costs decrease between 20 and 30 percent each time the accumulated experience for a product or commodity doubles. This same concept can be applied to the MOS EPROM price learning curve.

The objective of this section is to illustrate the application of learning curves to overall MOS EPROM and specific MOS EPROM device density prices. The curves are plotted on a logarithmic scale in order to show the relationship of the percent change in price relative to the percent change in cumulative volume as a straight line. This more easily allows the user to calculate the rate of price change within the growth in cumulative volume.

MOS EPROM PRICE LEARNING CURVES

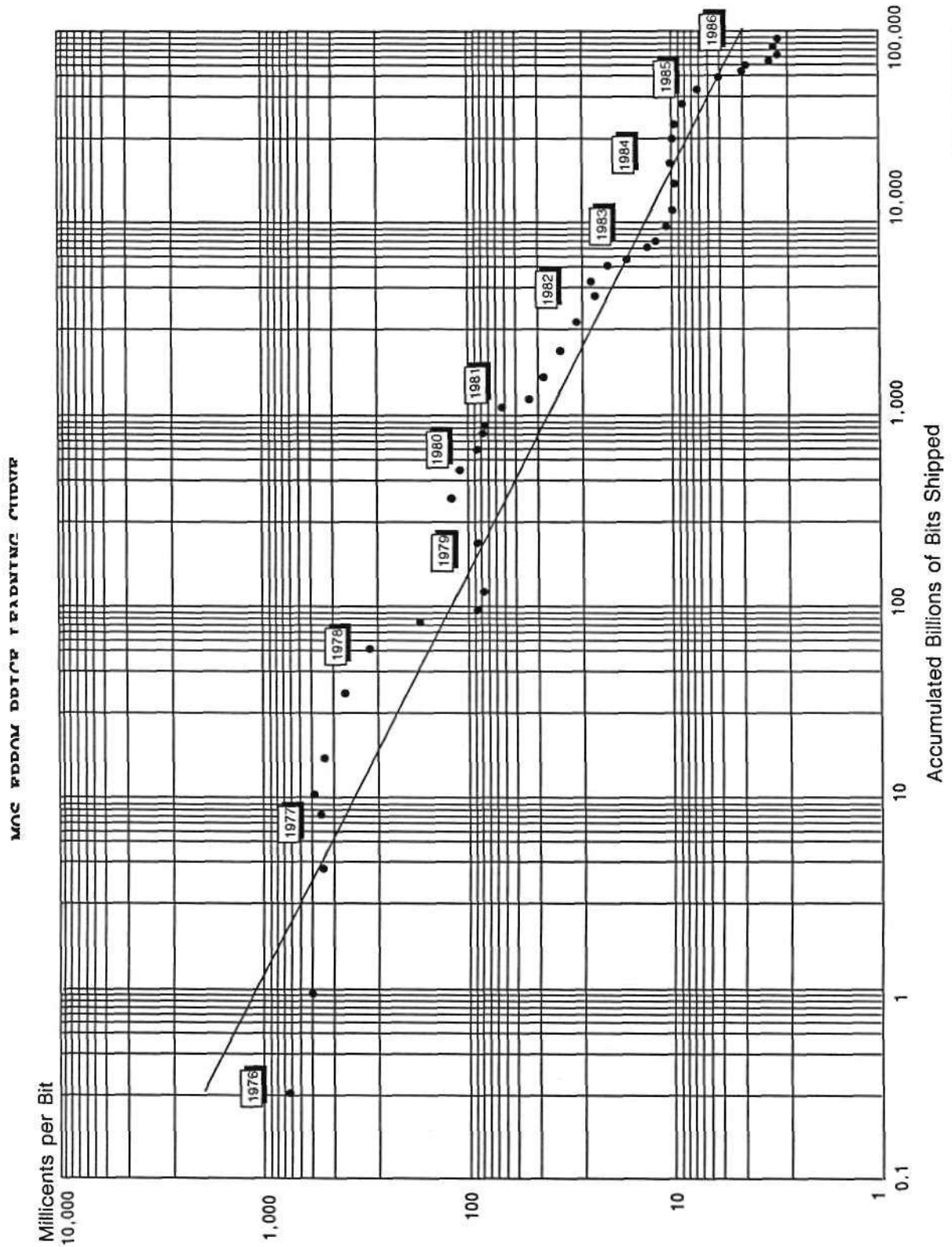
Figure 1 encompasses the accumulated bits shipped for total MOS EPROMs from 1976 through 1986, illustrating how prices gravitate around the declining slope of an experience curve over time. Figures 2 through 4 illustrate price learning curve developments for the 16K, 64K, and 256K MOS EPROM densities through 1986.

While MOS EPROM prices traditionally followed an 80 percent decline, as shown in Figure 2, certain notable changes occurred over time. During the industry boom periods of 1978 and 1979 and again in 1983 and 1984, product shortages and vendor controls drove prices up above the 80 percent curve norm. During the early 1980s and again in 1985 and 1986, the industry balloon burst. Capacity utilization rates declined; prices dropped, sometimes below cost; and the industry fell into a deep recession.

A price stabilization period in 1986, as a result of the trade agreement between the United States and Japan, is reflected at the end of the curve. Foreign market values (FMVs) were stipulated in the agreement to act as minimum prices for EPROMs fabricated in Japan and sold in the United States. (These FMVs are based on a cost model and are determined by the U.S. Department of Commerce on a quarterly basis.) The trade agreement also called for a narrowing of the price differentials between U.S. prices and those in Asia and Europe.

MOS EPROM--Price Learning Curves

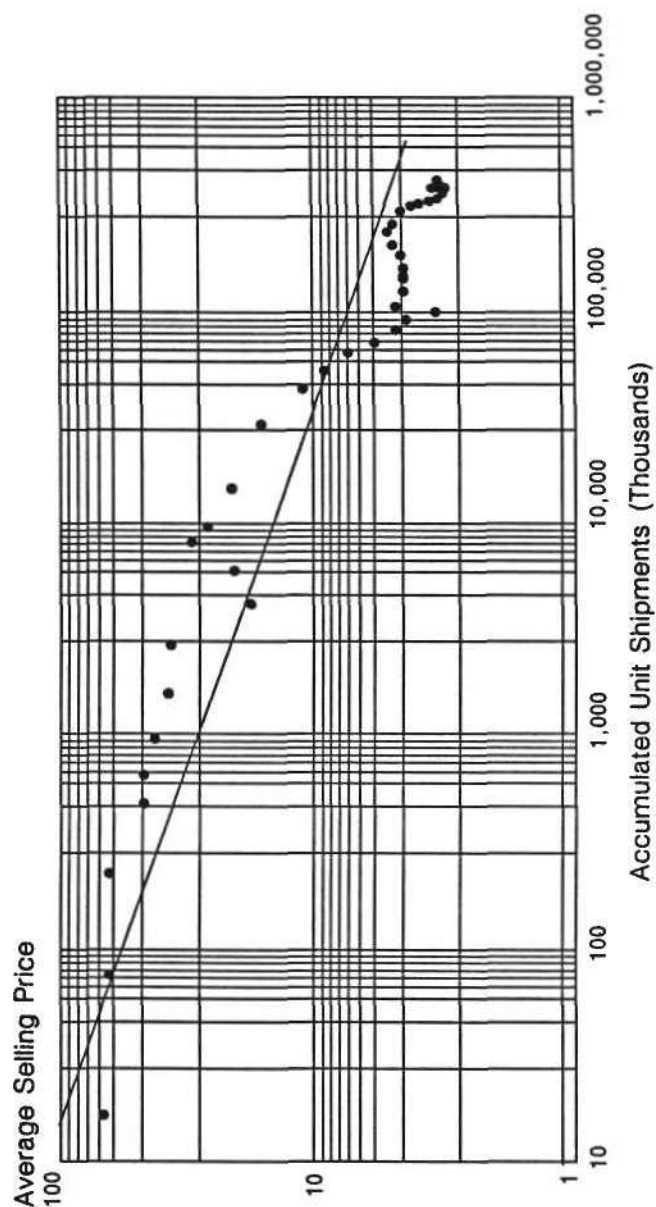
Figure 1



MOS EPROM--Price Learning Curves

Figure 2

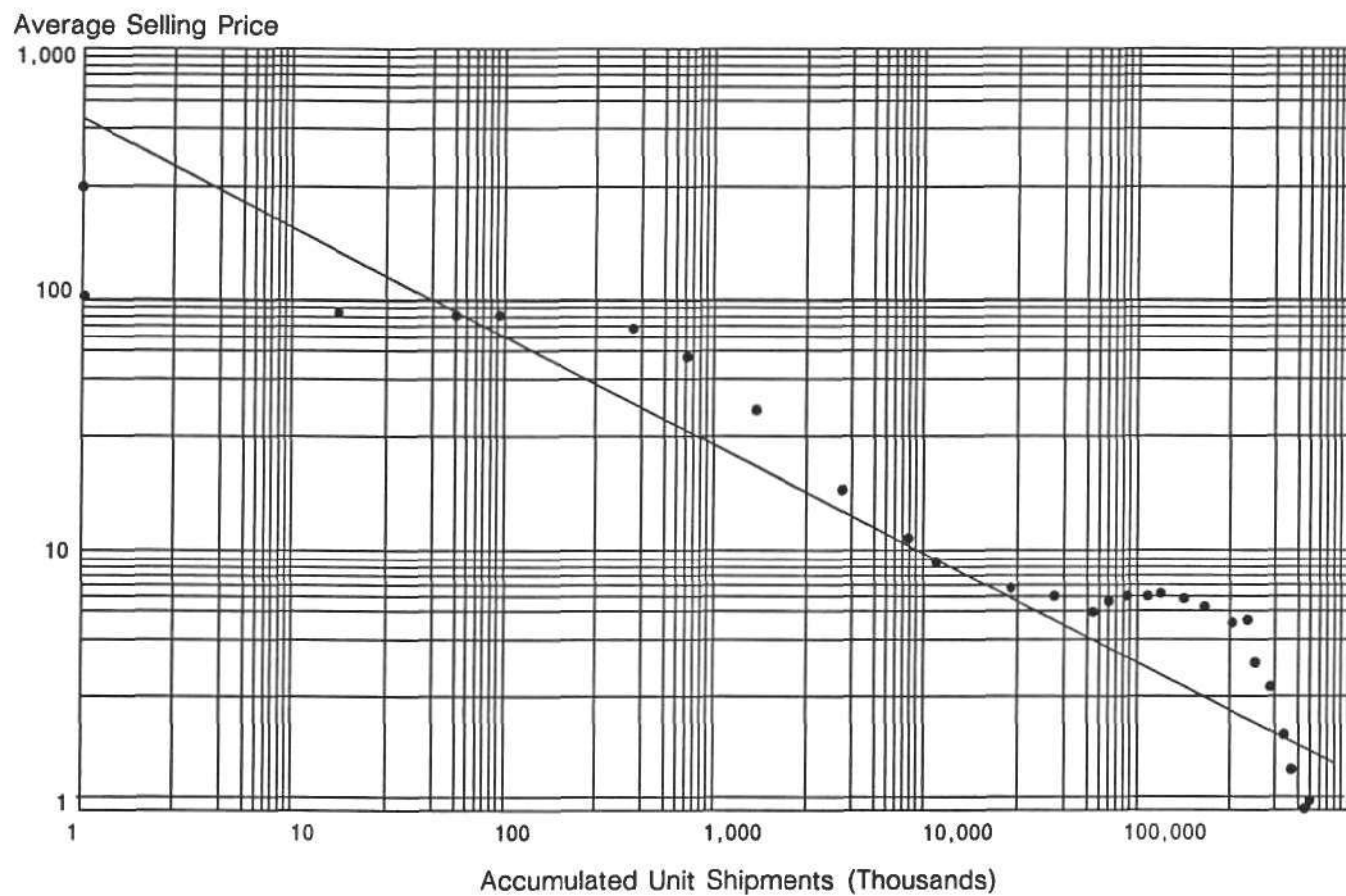
16K MOS EPROM PRICE LEARNING CURVE



Source: Dataquest
May 1987

Figure 3

64K MOS EPROM PRICE LEARNING CURVE

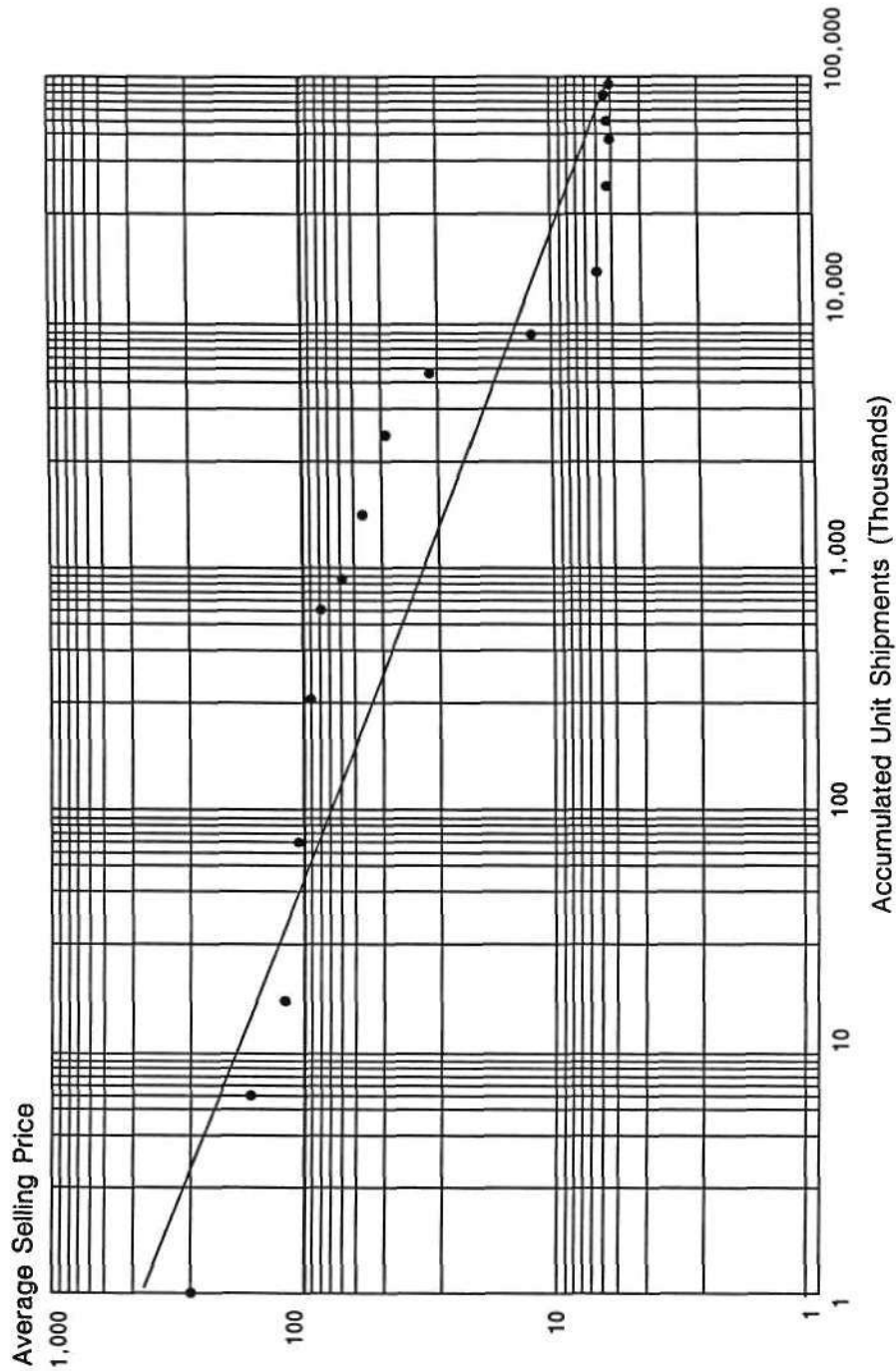


Source: Dataquest
May 1987

MOS EPROM--Price Learning Curves

Figure 4

256K MOS EPROM PRICE LEARNING CURVE



Source: Dataquest
May 1987

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Company _____

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Type

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☐ 02 Research
☐ 03 Marketing
☐ 04 Client Care
☐ 05 Conference
☐ 06 Internal
☐ 07 Consulting

Client Contact

- ☐ 01 Industry
☐ 02 FSP
☐ 03 Prudential-Bache
☐ 04 Other DQ Service
☐ 05 CIO Adviser
☐ 12 SES
☐ 13 Corporate Technology

Non-Client Contact

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☐ 07 Press (Copy PR Dept.)
☐ 08 Consultant
☐ 09 Industry Source
☐ 10 Recruiting (Copy Pers)
☐ 11 Other (Specify) _____

Medium:

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DISCUSSION _____

ACTION _____

MOS EPROM--Price Learning Curves

OVERVIEW OF PRICE LEARNING CURVES

Applying learning curves to MOS EPROM product prices can be a strategic tool for long-range business planning and analysis. Unlike cost experience curves, price curves are heavily influenced by extraneous market forces such as competition, substitute technology, general economic conditions, and/or supply and demand dynamics. The experience curve concept was developed by the Boston Consulting Group in the late 1960s. The concept is based on historical studies showing that costs decrease between 20 and 30 percent each time the accumulated experience for a product or commodity doubles. This same concept can be applied to the MOS EPROM price learning curve.

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MOS EPROM PRICE LEARNING CURVES

Figure 1 encompasses the accumulated bits shipped for total MOS EPROMs from 1976 through 1987, illustrating how prices gravitate around the declining slope of an experience curve over time. Figures 2 through 5 illustrate price learning curve developments for the 16K, 64K, 256K, and 1-Mbit MOS EPROM densities through 1987.

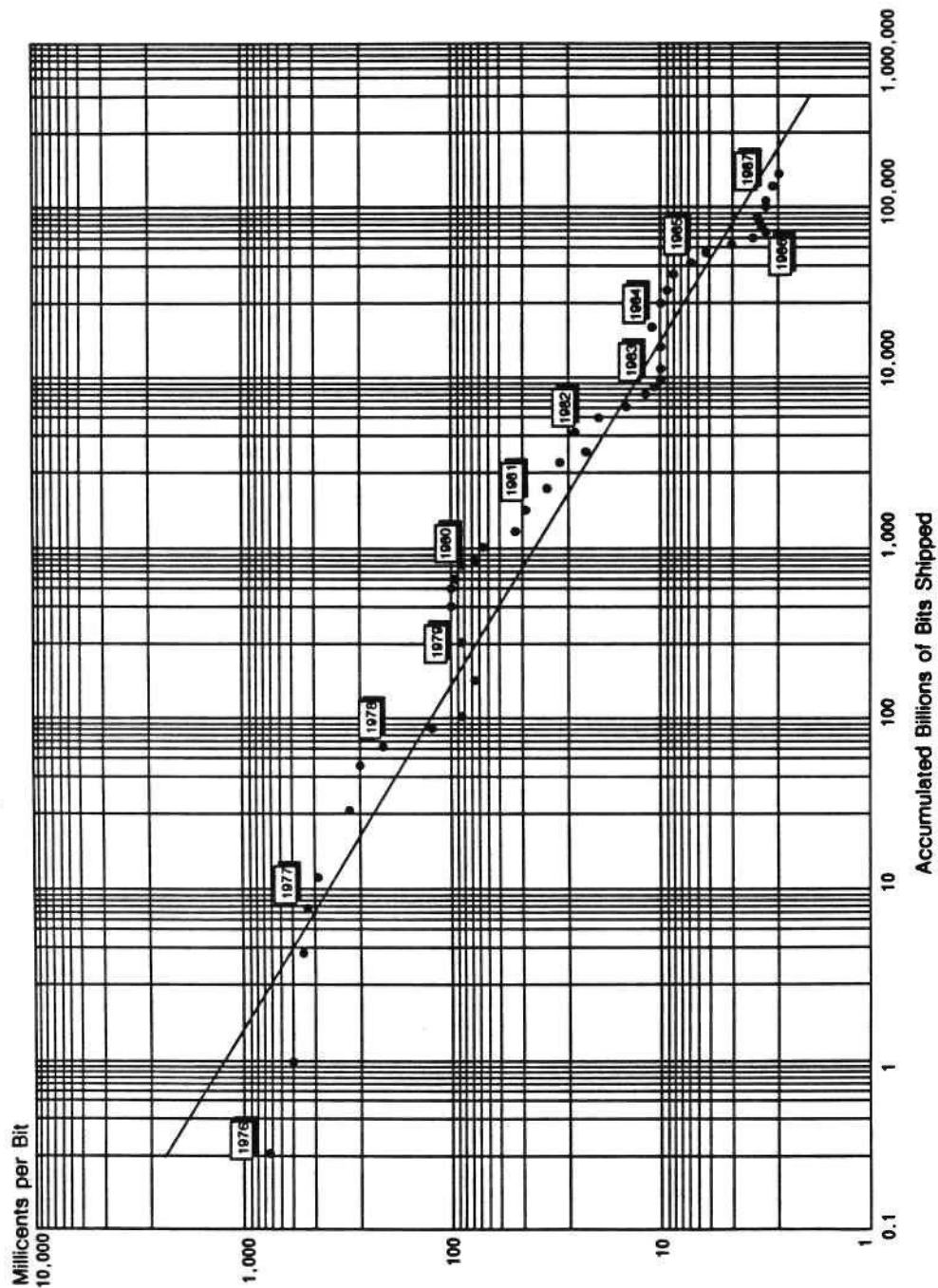
While MOS EPROM prices traditionally followed an 80 percent decline, as shown in Figure 2, certain notable changes occurred over time. During the industry boom periods of 1978 and 1979 and again in 1983 and 1984, product shortages and vendor controls drove prices up above the 80 percent curve norm. During the early 1980s and again in 1985 and 1986, the industry balloon burst. Capacity utilization rates declined; prices dropped, sometimes below cost; and the industry fell into a deep recession.

A price stabilization period in 1986, as a result of the trade agreement between the United States and Japan, is reflected at the end of the curve. Foreign market values (FMVs) were stipulated in the agreement to act as minimum prices for EPROMs fabricated in Japan and sold in the United States. (These FMVs are based on a cost model and are determined by the U.S. Department of Commerce on a quarterly basis.) The trade agreement also called for a narrowing of the price differentials between U.S. prices and those in Asia and Europe. In the first half of 1987, MITI imposed EPROM production cuts just as demand was beginning to pick up. Shortages and increased demand in 1987 have raised EPROM prices substantially.

MOS EPROM--Price Learning Curves

Figure 1

MOS EPROM Price Learning Curve*

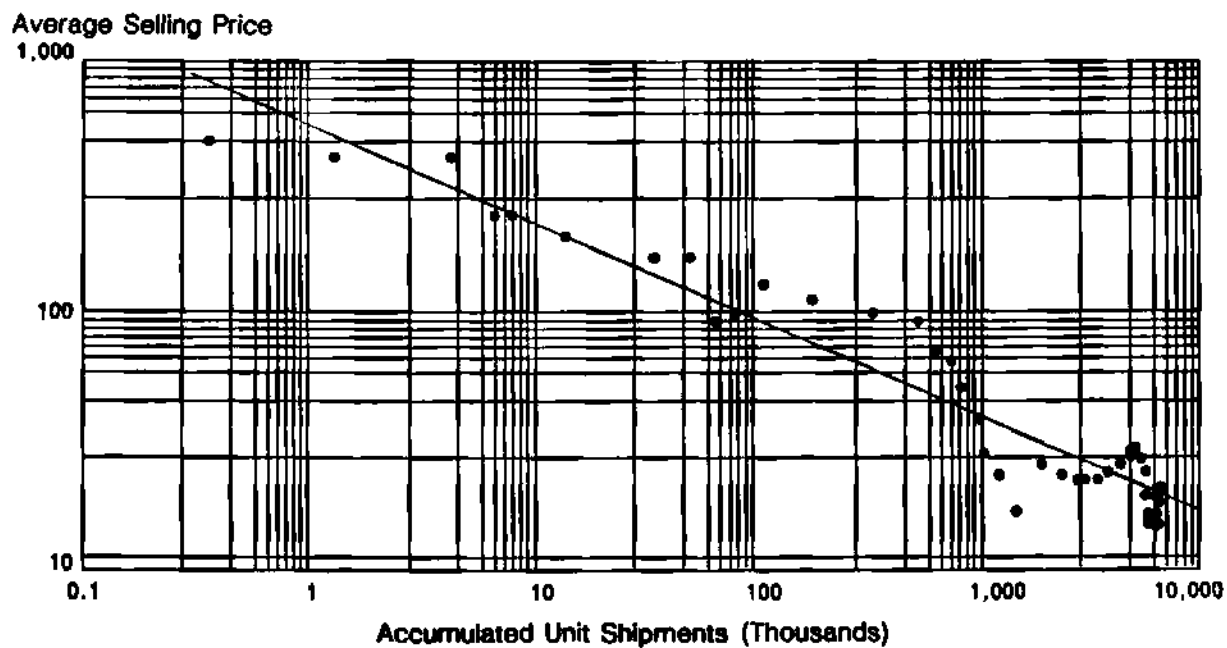


* The EPROM price learning curve is based on actual quarterly data from 1976 through 1987.

Source: Dataquest
July 1988

Figure 2

16K MOS EPROM Price Learning Curve*

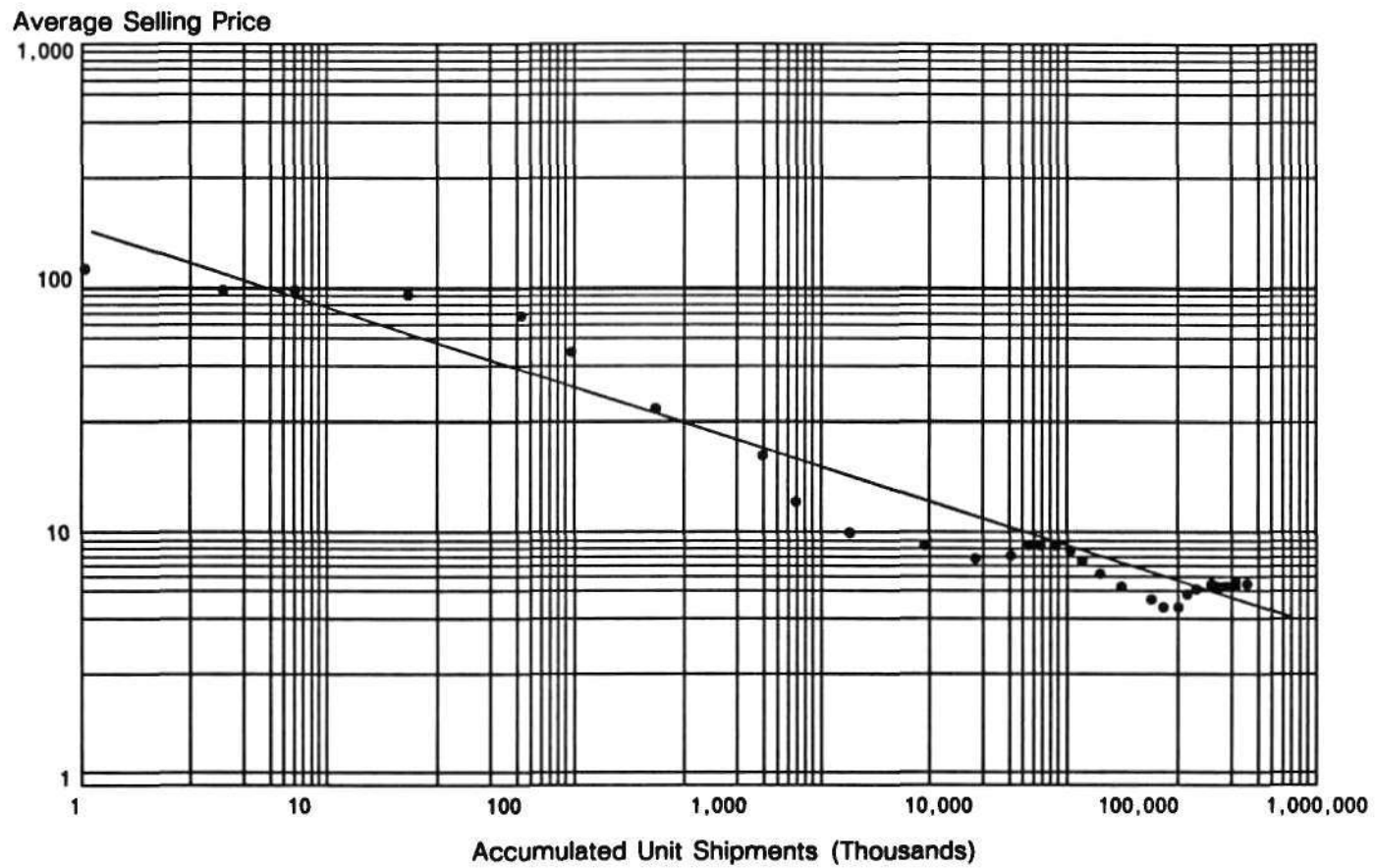


* The 16K EPROM price learning curve is based on actual quarterly data from 1976 through 1987

Source: Dataquest
July 1988

Figure 3

64K MOS EPROM Price Learning Curve*

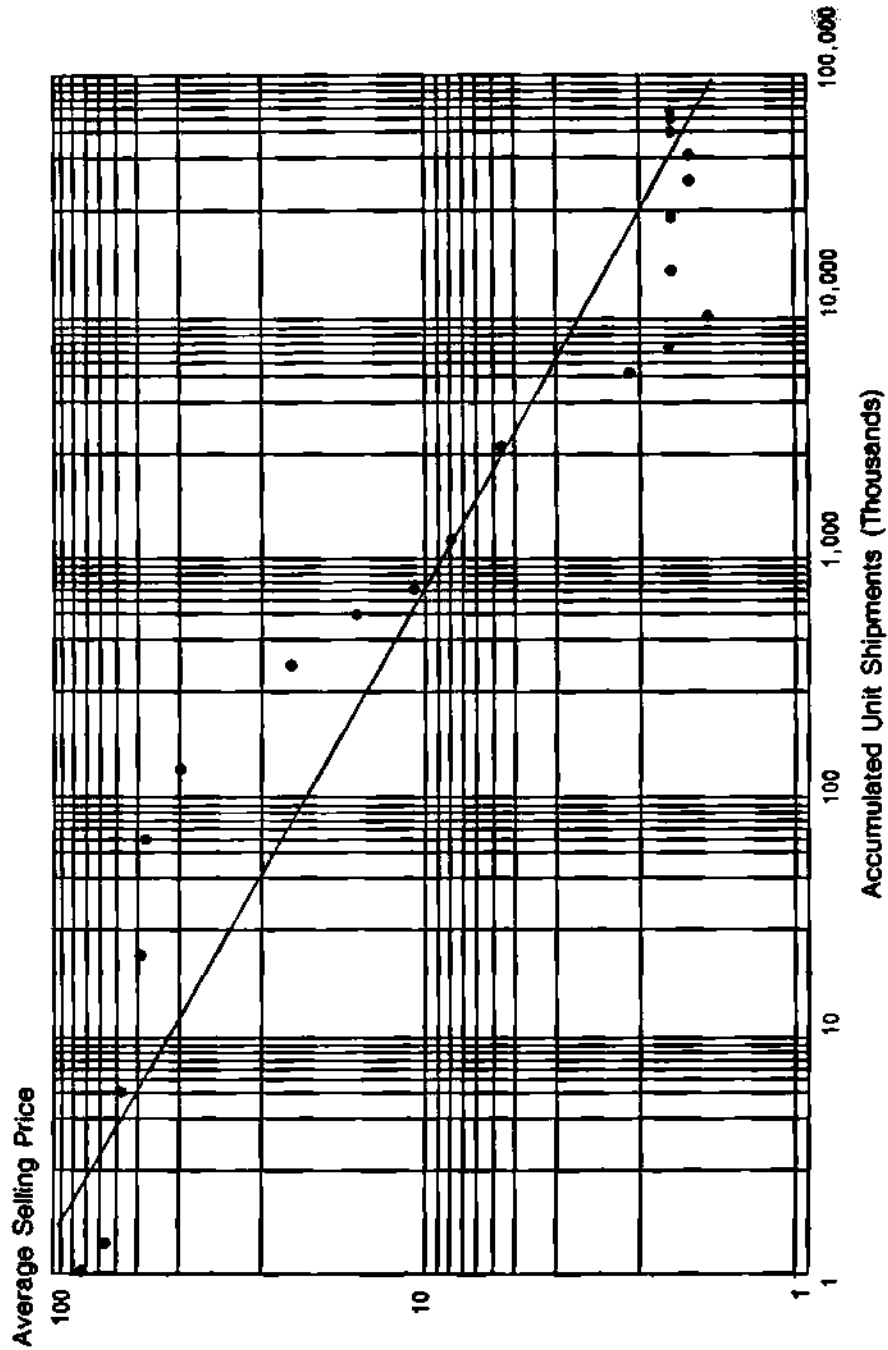


* The 64K EPROM price learning curve is based on actual quarterly data from 1980 through 1987.

Source: Dataquest
July 1988

MOS EPROM--Price Learning Curves

Figure 4
256K MOS EPROM Price Learning Curve*

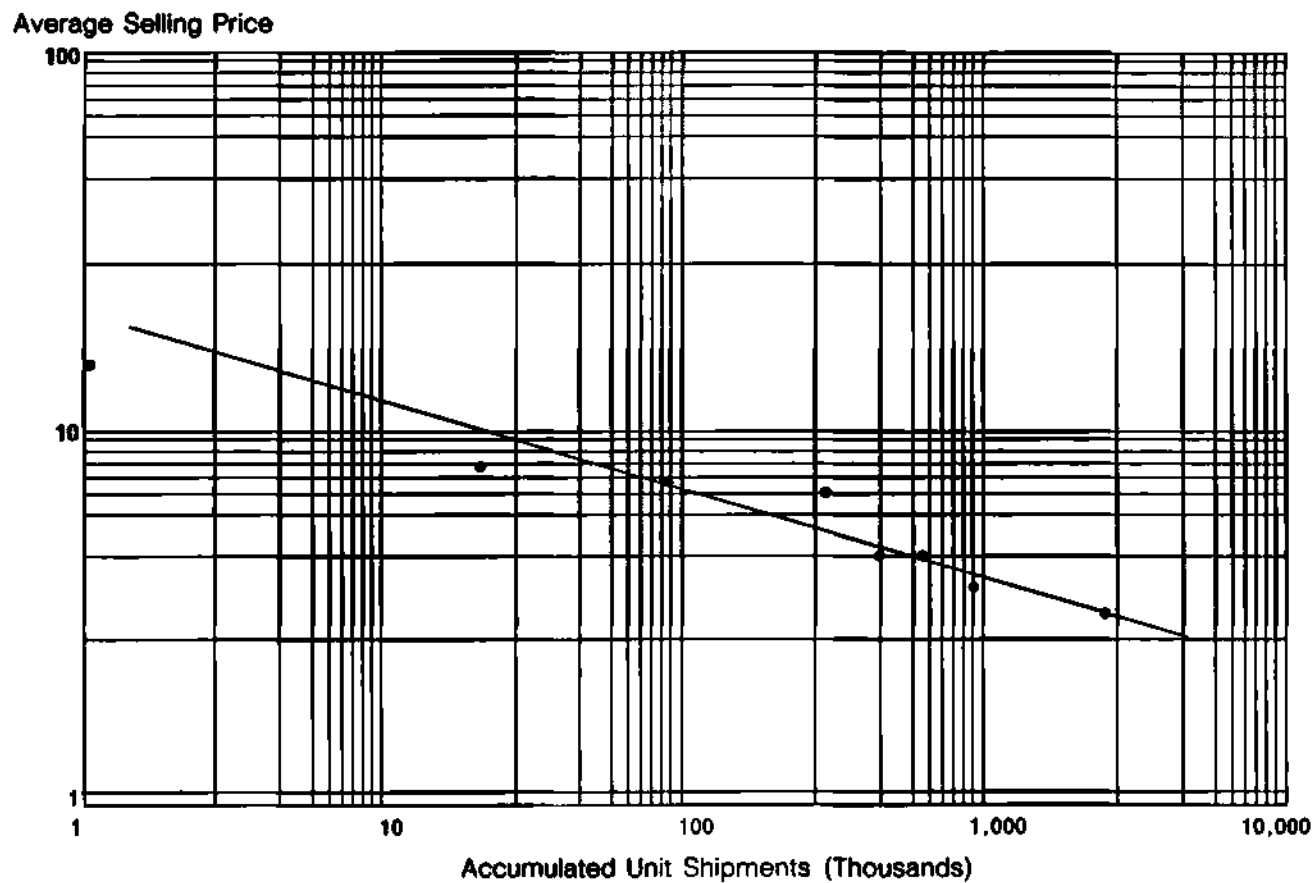


* The 256K EPROM price learning curve is based on actual quarterly data from 1982 through 1987.

Source: Dataquest
July 1988

Figure 5

1-Mbit MOS EPROM Price Learning Curve*



* The 1-Mbit EPROM price learning curve is based on actual quarterly data from 1986 through 1987.

Source: Dataquest
July 1988

MOS EPROM--Price Learning Curves

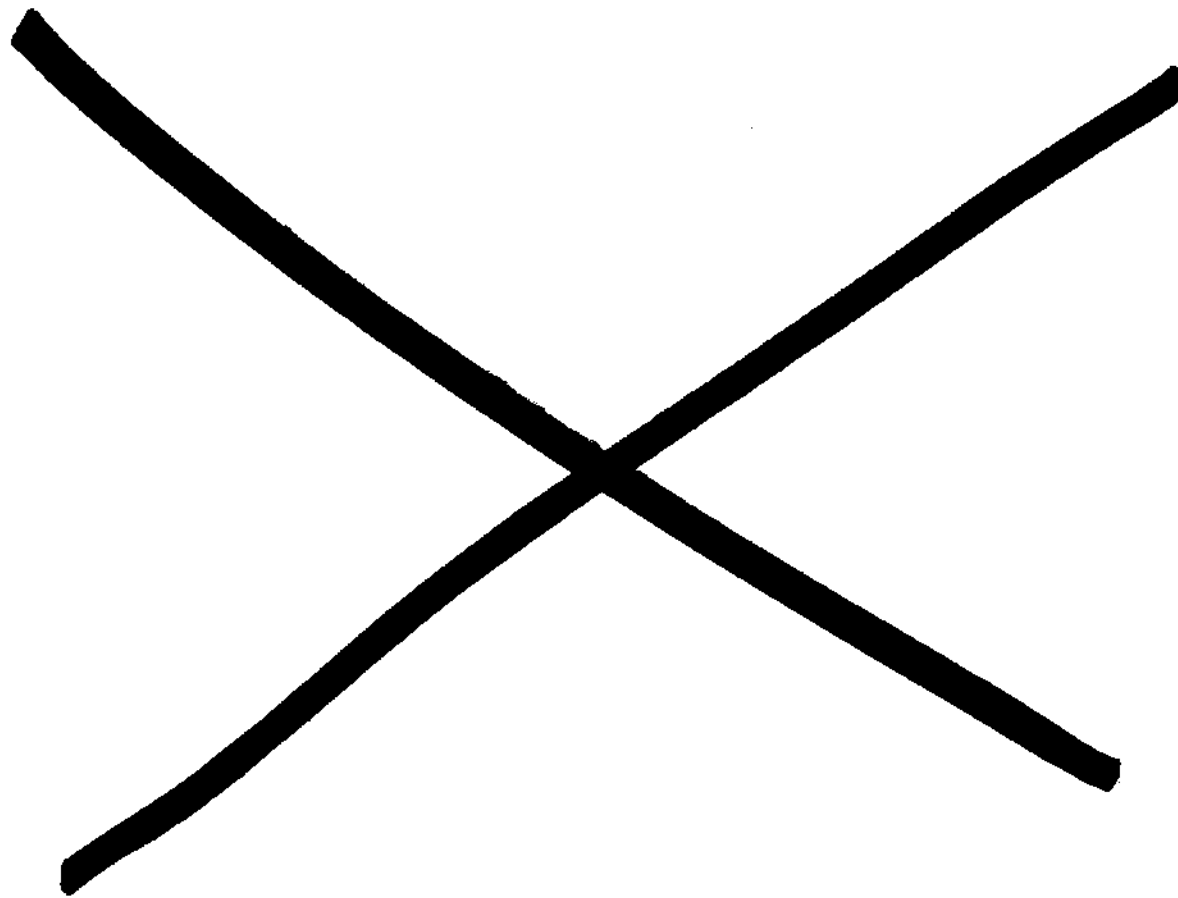
DATAQUEST ANALYSIS

Trade agreement FMVs and MITI-imposed production cuts continue to play a major role in the EPROM price learning curves. Although the learning curve for the 1-Mbit EPROM is steep, the curve began at a lower level than that of previous generations. Introduced during a semiconductor downturn, 1-Mbit EPROM development and acceptance has been slow. These factors, in conjunction with continued political intervention, have resulted in slowly declining prices.

As nonvolatile memory product development moves into the 2-Mbit, 4-Mbit, and 8-Mbit densities at submicron levels, manufacturers will no longer be able to afford the high cost of R&D investment with minimal profit margins. The manufacturer's concerns for profits and cautious buildup in capacity may very well change the structure of the EPROM product area and the learning curve slope over the next five years.

MOS EPROM--Price Learning Curves

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EPROM--Vendor Base Analysis

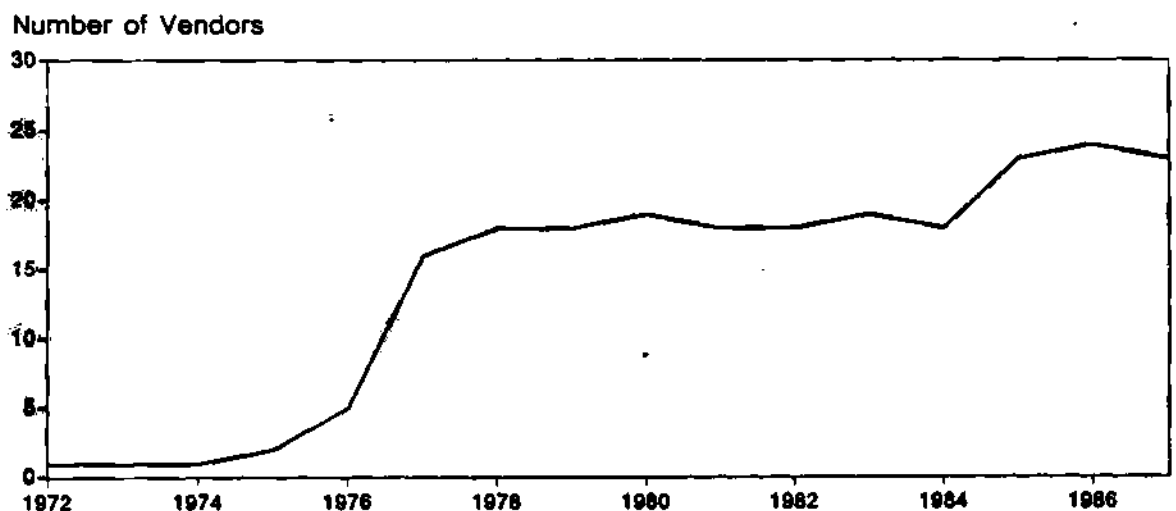
MOS EPROM VENDOR BASE OVERVIEW

Today's MOS EPROM market is a highly competitive and very commodity-oriented product area. It has also been characterized as an area fraught with price erosion and rapid changes in technology. Since 1972, the number of EPROM suppliers has grown from a vendor base of 1, as shown in Figure 1, to a base of 23. Dataquest expects the EPROM vendor base to continue to fluctuate and possibly decline in 1988 and 1989.

Historically, the number of vendors entering the market as well as departing from the market has been increasing, as shown in Figure 2. The companies that have left the market, however, either represented a marginal share of the EPROM market or were absorbed by larger companies. At the same time, those that entered the market, especially during the 1982 through 1987 time frame, made great gains in market share.

Figure 1

Total MOS EPROM Vendor Base

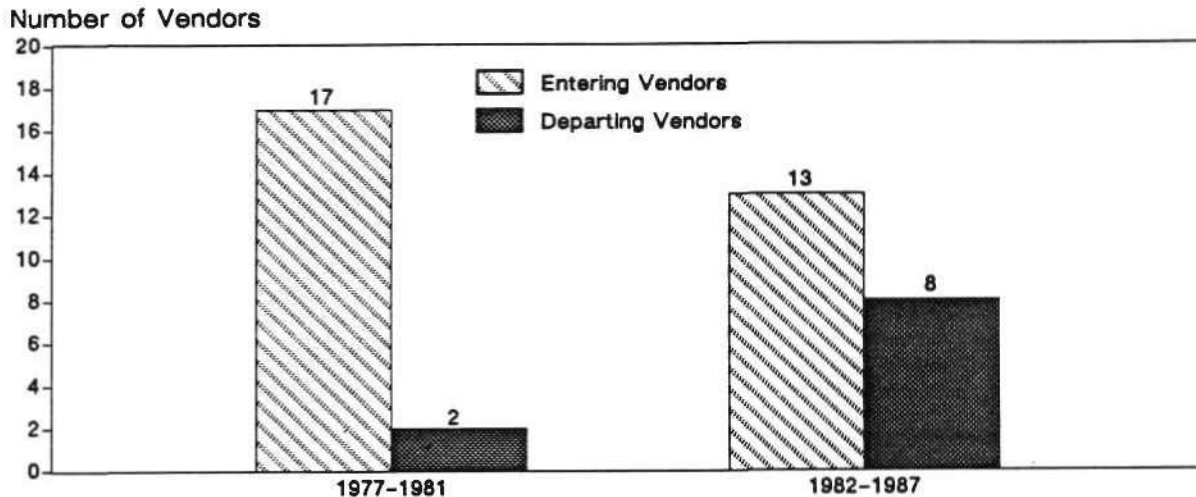


Source: Dataquest
July 1988

EPROM--Vendor Base Analysis

Figure 2

MOS EPROM Entering and Departing Vendors



Source: Dataquest
July 1988

A radical shift in vendor shares has occurred as a result of increased competition. (A summary of EPROM shares by vendor is presented in the "EPROM—Market Share" section of this notebook.) In 1987, in a field of 23 competitors, the average revenue per vendor was \$37.9 million, as shown in Table 1. The distribution of market share shows a heavy concentration on the top 10 manufacturers. Since 1978, the top 10 companies have held more than 90 percent share of the market, while the top five vendors have held more than 60 percent share of the market. In 1987, Intel, Fujitsu, Hitachi, Mitsubishi, and Toshiba held the top five positions in the MOS EPROM market, respectively, followed by AMD, Texas Instruments, SGS, NEC, and National Semiconductor.

If we look at the vendor base by region, as illustrated in Figure 3, we see that the Japanese have made substantial inroads in the worldwide supplier base, equaling the U.S. base over time, with Europe holding marginal share during the last five years and with the Korean base entering in 1986. Figures 4 through 10 present the regional breakout of vendors for the 16K to 1-Mbit densities.

EPROM--Vendor Base Analysis

Table 1

MOS EPROM Top 5/10 Vendor Concentration

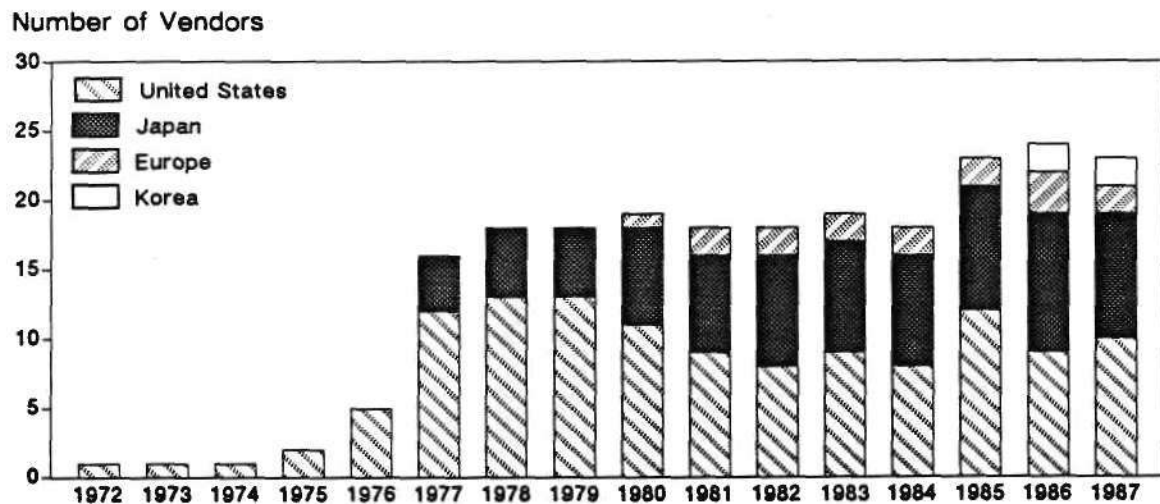
<u>Top 5/10 Concentration</u>	<u>1978</u>	<u>1979</u>	<u>1980</u>	<u>1981</u>	<u>1982</u>
Number of Vendors	18	18	19	18	18
Average Revenue per Vendor (\$M)	\$11.0	\$30.9	\$35.1	\$21.6	\$33.9
Top 10 Share	99	97	91	96	96
Top 5 Share	90	79	71	76	72

<u>Top 5/10 Concentration</u>	<u>1983</u>	<u>1984</u>	<u>1985</u>	<u>1986</u>	<u>1987</u>
Number of Vendors	19	19	23	24	23
Average Revenue per Vendor (\$M)	\$51.7	\$73.3	\$43.3	\$37.9	\$58.6
Top 10 Share	87	95	96	96	91
Top 5 Share	61	68	68	71	61

Source: Dataquest
July 1988

Figure 3

Total Vendor Base by Region



Source: Dataquest
July 1988

EPROM--Vendor Base Analysis

Figure 4

16K MOS EPROM Vendor Base by Region

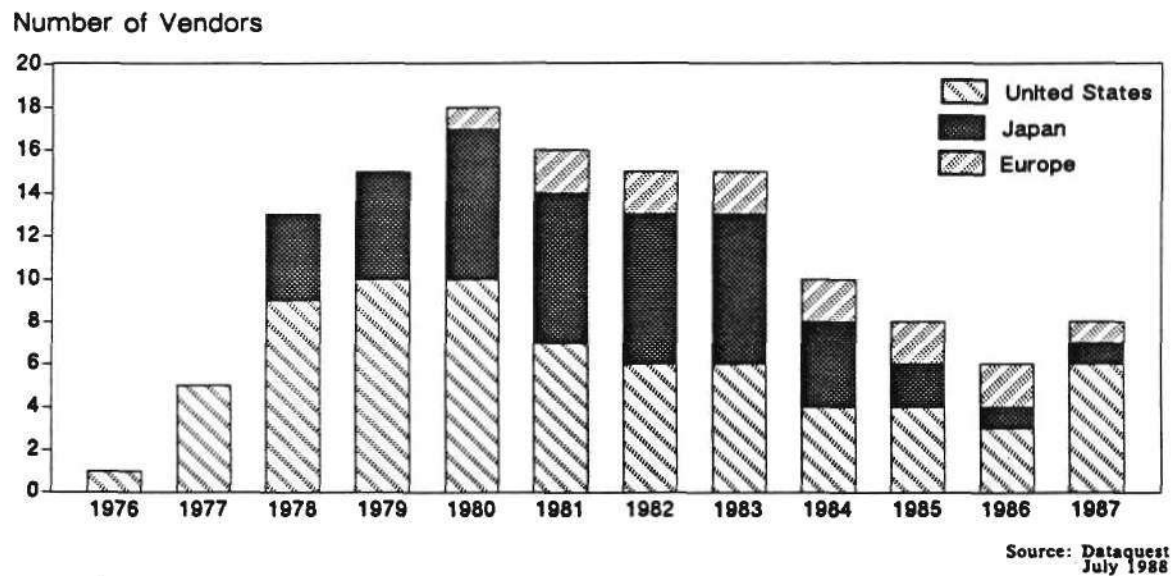
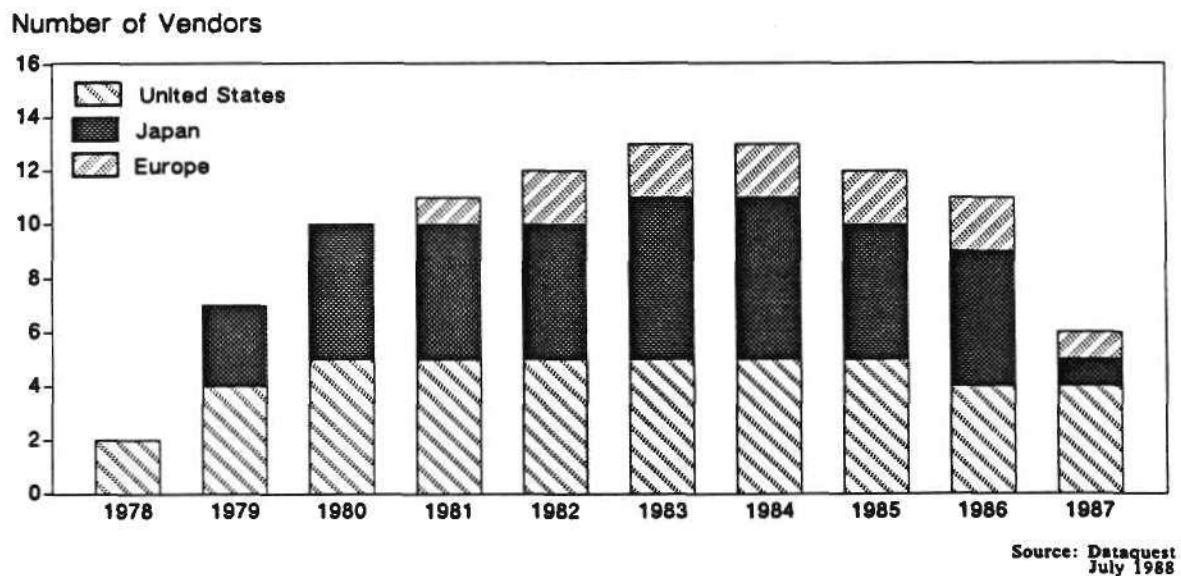


Figure 5

32K MOS EPROM Vendor Base by Region



EPROM--Vendor Base Analysis

Figure 6

64K MOS EPROM Vendor Base by Region

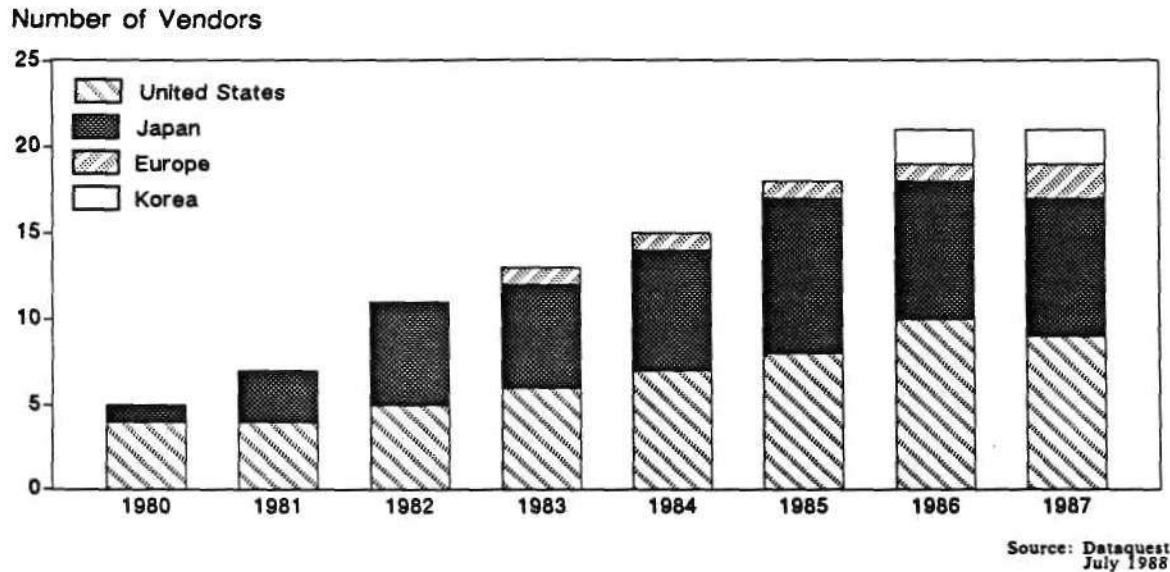
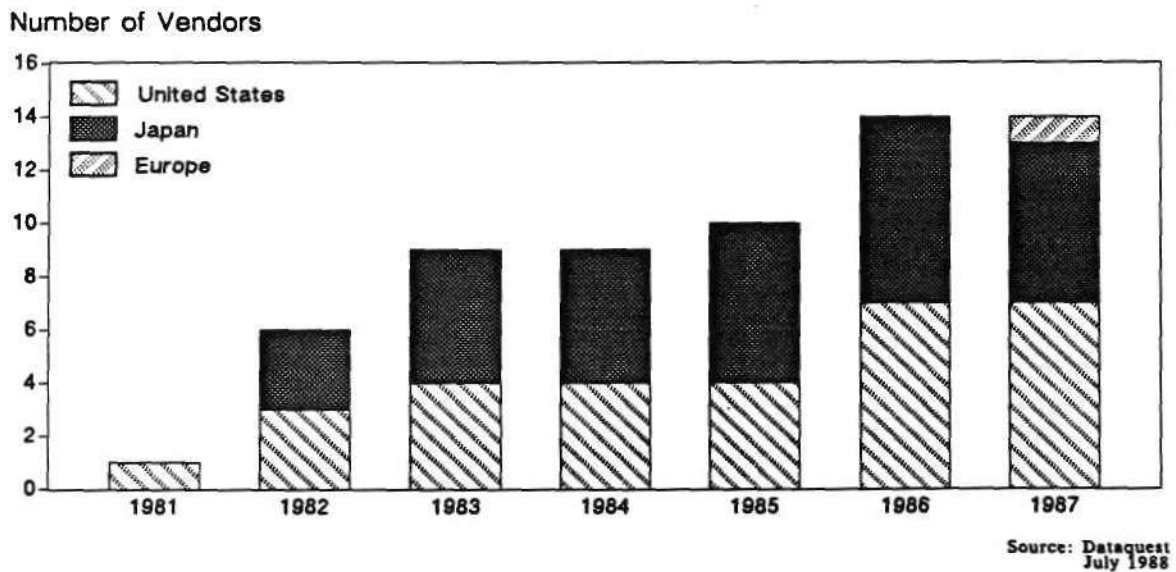


Figure 7

128K MOS EPROM Vendor Base by Region



EPROM--Vendor Base Analysis

Figure 8

256K MOS EPROM Vendor Base by Region

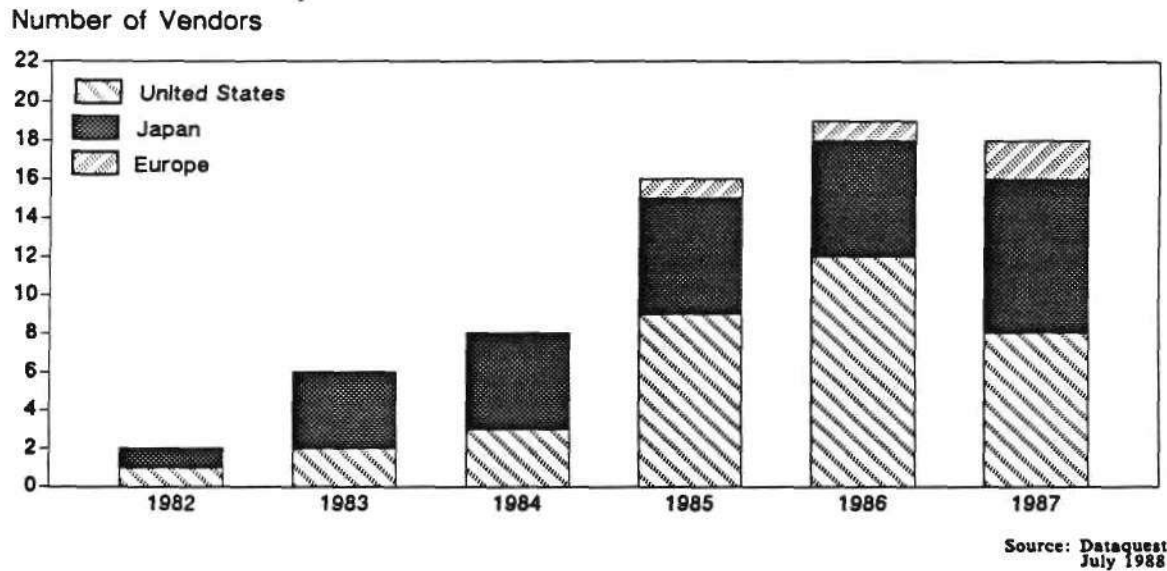
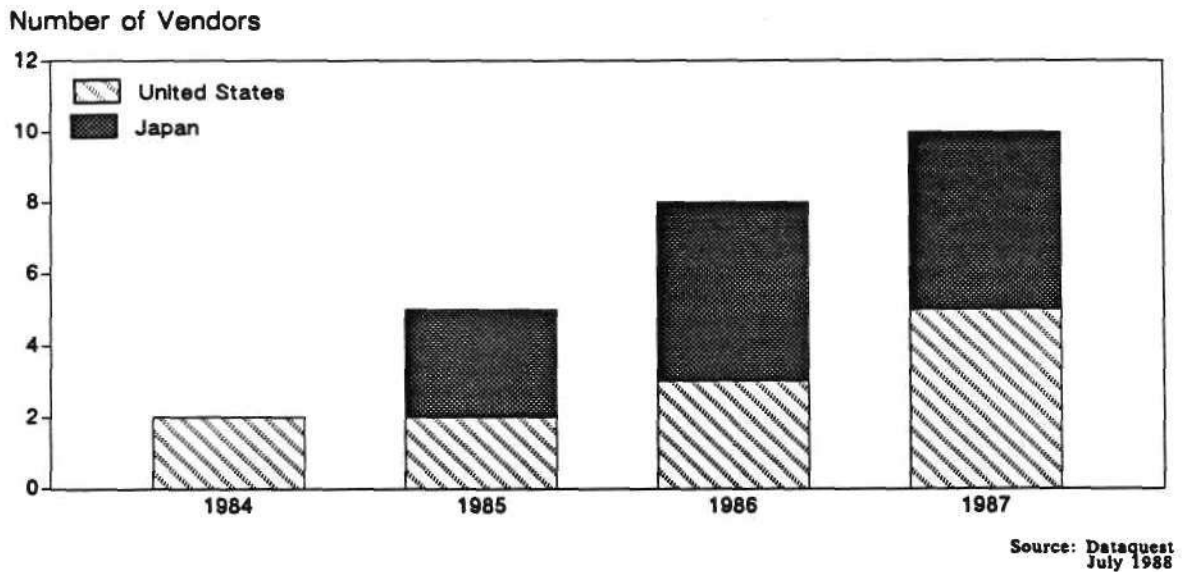


Figure 9

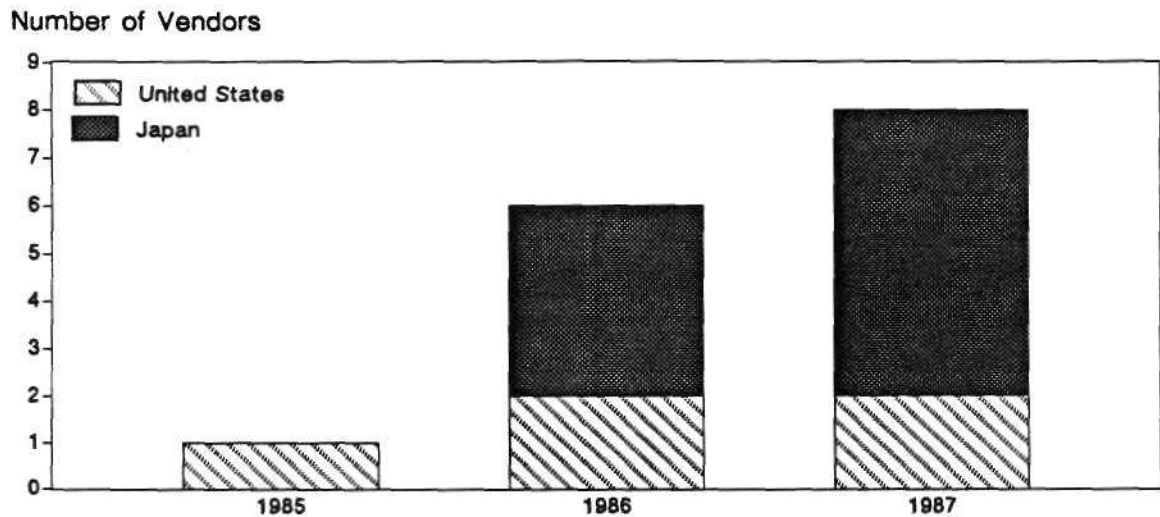
512K MOS EPROM Vendor Base by Region



EPROM--Vendor Base Analysis

Figure 10

1-Mbit MOS EPROM Vendor Base by Region



Source: Dataquest
July 1988

The EPROM market continues to be dominated by Japanese suppliers, as shown in Table 2. The average revenue per Japanese vendor surpassed that of the U.S. vendor in 1982, and it increased significantly during the 1983 through 1986 time frame. Japanese vendors boosted their producer share of the market to gain 54 percent in 1985 and 56 percent in 1986.

EPROM--Vendor Base Analysis

Table 2

EPROM Regional Vendor Concentration

<u>Regional Concentration</u>	<u>1978</u>	<u>1979</u>	<u>1980</u>	<u>1981</u>	<u>1982</u>
Number of U.S. Vendors	13	13	11	9	8
U.S. Market Share	92%	88%	72%	66%	52%
Average Revenue per Vendor (\$M)	\$14.5	\$40.2	\$44.2	\$31.0	\$33.7
Number of Japanese Vendors	5	5	7	7	8
Japanese Market Share	8%	13%	26%	33%	45%
Average Revenue per Vendor (\$M)	\$ 1.9	\$11.6	\$23.8	\$15.5	\$37.4
Number of European Vendors	0	0	1	2	2
European Market Share	0	0	3%	0	3%
Average Revenue per Vendor (\$M)	0	0	\$17.6	\$ 0.3	\$ 5.7
Number of Korean Vendors	0	0	0	0	0
Korean Market Share	0	0	0	0	0
Average Revenue per Vendor (\$M)	0	0	0	0	0

<u>Regional Concentration</u>	<u>1983</u>	<u>1984</u>	<u>1985</u>	<u>1986</u>	<u>1987</u>
Number of U.S. Vendors	9	8	12	9	10
U.S. Market Share	49%	46%	40%	40%	45%
Average Revenue per Vendor (\$M)	\$56.2	\$75.0	\$35.5	\$ 41.8	\$ 57.7
Number of Japanese Vendors	8	8	9	10	9
Japanese Market Share	49%	50%	54%	56%	47%
Average Revenue per Vendor (\$M)	\$58.7	\$86.0	\$59.1	\$ 50.3	\$ 75.9
Number of European Vendors	2	2	2	3	2
European Market Share	3%	4%	6%	5%	8%
Average Revenue per Vendor (\$M)	\$ 9.3	\$15.6	\$19.3	\$ 10.2	\$ 43.3
Number of Korean Vendors	0	0	0	2	2
Korean Market Share	0	0	0	0	0
Average Revenue per Vendor (\$M)	0	0	0	\$0.013	\$0.090

Source: Dataquest
July 1988

EPROM--Vendor Base Analysis

DATAQUEST ANALYSIS

Dataquest expects a number of scenarios to occur in the 1988 and 1989 time frame, changing the structure of the MOS EPROM business for both vendors and users, as follows:

- A number of vendors will leave the market. As a result of MITI imposed reduction of EPROM shipments to the United States, major Japanese suppliers temporarily have stopped shipments of certain EPROM densities.
- Growth in the vendor base along with the high cost of new product development and less available market share will promote more strategic alliances between manufacturers.
- Major manufacturers and start-ups will continue to focus EPROM product development on the high-performance, premium-priced CMOS market segment. These high-performance products are targeted at the electronic systems market, which requires speeds (15ns to 50ns) traditionally afforded by bipolar PROMs.
- Several manufacturers are breaking away from the 150ns-and-above EPROM speeds and are concentrating their product development along one of two speed segments. Some of the larger manufacturers are concentrating their product portfolios in the 85ns to 120ns speed range, while the Cypress look-alikes are focusing on the high-performance niche market in the sub-70ns bipolar replacement speed range.
- Flash EPROM/EEPROMs employing electrical write-in and erase capability, with transistor cells reduced from three to one and packaged in plastic, are now emerging. High-performance product areas are being targeted by companies such as Intel, National Semiconductor, Seeq, Texas Instruments, and Toshiba.

Dataquest expects that the next two years in the EPROM market will continue to be two years of fragmentation—more new products, more new suppliers, and less revenue. In the midst of all of this change, the U.S./Japan semiconductor trade negotiations will continue. While political constituents from both sides will continue to strive for conflict resolution, with a firm resolve to protect the interests of each other's constituency, the U.S./European users will pay the cost, and the U.S. manufacturers will reap the profits. Those manufacturers that easily adapt to these market changes will survive and prosper. We believe that the quality of management, strength of financing, and product innovation will determine who stays in the EPROM market and who leaves.

EPROM--Vendor Base Analysis

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MOS EPROM--Market Shares

OVERVIEW OF MOS EPROM MARKET SHARES

An integral part of Dataquest's MOS EPROM forecast is analyzing the EPROM market by gathering shipment data from each EPROM manufacturer. The data and end analysis provide insights into the EPROM market and reinforce estimates of consumption, production, and company revenue. The information in this section should be interpreted as follows:

- Overall market shares are based on all "dollarized" unit shipments. Each density's units are multiplied by that density's overall average selling price (ASP) for the year. All density dollar values are then added to arrive at each company's total MOS EPROM market share for the specific year.
- The totals for all companies reflect worldwide production. Although these numbers are in dollars, they do not relate to a company's true EPROM revenue, as worldwide ASPs can vary by region, technology, density, or package type.

We believe that the estimates presented here are the most accurate and meaningful generally available today. The EPROM data presented in the tables were derived from interviews with knowledgeable manufacturers and users.

MOS EPROM--MARKET SHARE DATA

The following market share estimates provide a historical view of data from 1976 through 1986. The 1986 data were gathered prior to year-end 1986 and, hence, are subject to revision. The following tables cover market shares in terms of units, dollars, and percentages for all MOS EPROM densities:

- Table 1--EPROM Market Shares (Percentages)
- Table 2--EPROM Market Shares (Dollarized Unit Shares in Thousands)
- Table 3--EPROM Regional Shares (Percentages)
- Table 4--EPROM Regional Shares (Dollarized Unit Shares in Thousands)
- Table 5--EPROM Top 10 Shares (Percentages)
- Table 6--8K EPROM Market Shares (Percentages)
- Table 7--16K EPROM Market Shares (Percentages)

MOS EPROM--Market Shares

- Table 8--32K EPROM Market Shares (Percentages)
- Table 9--64K EPROM Market Shares (Percentages)
- Table 10--128K EPROM Market Shares (Percentages)
- Table 11--256K EPROM Market Shares (Percentages)
- Table 12--512K EPROM Market Shares (Percentages)
- Table 13--1-Mbit EPROM Market Shares (Percentages)

Highlights of the overall EPROM market include the following:

- Regionally, U.S. EPROM suppliers slowly lost market share from 1976 through 1981. In 1976, Intel dominated the market with 78 percent of the worldwide EPROM market. From 1978 through 1981, Intel and Texas Instruments dominated the worldwide EPROM market. By 1986, Intel was leading the market again, followed by Hitachi and Mitsubishi.
- Japanese suppliers made their largest gains in EPROM market share from 1984 through 1986. By dominating the 64K and 128K EPROM sectors, they boosted their worldwide share to 50 percent. By 1986, they had captured 55.5 percent of the worldwide EPROM market.
- The EPROM market has always been heavily concentrated in the top five vendors. Despite the fact that the companies at the top have changed through the years, their shares have consistently averaged more than 60 percent of the market.

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- 04 Client Care
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- 05 Conference
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- 06 Internal
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- 07 Consulting

Client Contact

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- 02 FSP
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- 03 Prudential-Bache
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- 04 Other DQ Service
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- 05 CIO Adviser
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- 12 SES
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- 13 Corporate Technology

Non-Client Contact

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- 07 Press (Copy PR Dept.)
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- 08 Consultant
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DISCUSSION: _____

ACTION: _____

MOS EPROM—Market Shares

OVERVIEW OF MOS EPROM MARKET SHARES

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MOS EPROM---Market Shares

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MOS EPROM--Market Shares

Table 1
MOS EPROM Market Shares
(Percentages)

<u>Company</u>	<u>1976</u>	<u>1977</u>	<u>1978</u>	<u>1979</u>	<u>1980</u>	<u>1981</u>
AMD	0	0	3%	4%	3%	4%
Atmel	0	0	0	0	0	0
Cypress	0	0	0	0	0	0
Electronic Array	0	4%	1	1	0	0
Eurotechnique	0	0	0	0	0	0
Fairchild	0	0	2	2	4	1
Fujitsu	0	2	2	5	9	8
General Instrument	0	0	0	0	0	0
Goldstar	0	0	0	0	0	0
Hitachi	0	0	1	6	9	12
Hyundai	0	0	0	0	0	0
Intel	74%	59	44	27	23	29
Matsushita	0	0	0	0	0	1
Microchip Tech., Inc.	0	0	0	0	0	0
Mitsubishi	0	0	4	2	4	6
Mostek	0	0	0	4	3	3
Motorola	0	2	8	9	6	5
National	0	4	8	7	5	4
NEC	0	0	0	0	2	4
Okii	0	0	0	0	0	0
Ricoh	0	0	0	0	0	0
Rockwell	0	0	0	0	0	0
Seeq	0	0	0	0	0	0
Seiko-Epson	0	0	0	0	0	0
SGS	0	0	0	0	3	0
Sharp	0	0	0	0	0	0
Signetics	0	0	0	0	0	0
Synertek	0	0	0	0	0	0
Texas Instruments	4	10	28	30	24	20
Thomson	0	0	0	0	0	0
Toshiba	22	19	0	2	3	1
VLSI Technology	0	0	0	0	0	0
WaferScale	0	0	0	0	0	0
Others	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total	100%	100%	100%	100%	100%	100%

(Continued)

MOS EPROM--Market Shares

Table 1 (Continued)

MOS EPROM Market Shares (Percentages)

<u>Company</u>	<u>1982</u>	<u>1983</u>	<u>1984</u>	<u>1985</u>	<u>1986</u>	<u>1987</u>
AMD	7%	9%	10%	11%	8%	8%
Atmel	0	0	0	0	0	0
Cypress	0	0	0	0	0	0
Electronic Array	0	0	0	0	0	0
Eurotechnique	1	1	0	0	0	0
Fairchild	0	0	0	0	0	0
Fujitsu	12	11	11	12	9	12
General Instrument	0	0	0	0	2	0
Goldstar	0	0	0	0	0	0
Hitachi	12	15	17	16	16	10
Hyundai	0	0	0	0	0	0
Intel	28	24	16	18	23	19
Matsushita	0	0	0	0	0	0
Microchip Tech., Inc.	0	0	0	0	0	3
Mitsubishi	10	9	13	11	14	10
Mostek	1	0	0	0	0	0
Motorola	2	1	1	0	0	0
National	4	5	4	3	2	5
NEC	10	8	6	9	9	5
Oki	1	1	1	0	0	3
Ricoh	0	0	0	0	0	0
Rockwell	0	0	0	0	0	0
Seeq	0	1	3	2	1	0
Seiko-Epson	0	0	0	0	0	0
SGS	1	1	2	3	3	6
Sharp	0	0	0	0	0	0
Signetics	0	0	0	0	0	1
Synertek	0	0	0	0	0	0
Texas Instruments	8	11	11	6	4	6
Thomson	0	0	1	1	0	0
Toshiba	3	2	4	6	7	10
VLSI Technology	0	0	0	0	0	0
WaferScale	0	0	0	0	0	0
Others	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total	100%	100%	100%	100%	100%	100%

Note: Columns may not add to totals shown because of rounding.

Source: Dataquest
June 1988

MOS EPROM--Market Shares

Table 2

MOS EPROM Market Shares (Dollarized Unit Shares in Thousands)

<u>Company</u>	<u>1976</u>	<u>1977</u>	<u>1978</u>	<u>1979</u>	<u>1980</u>	<u>1981</u>
AMD	0	0	3,613	16,904	17,227	13,070
Atmel	0	0	0	0	0	0
Cypress	0	0	0	0	0	0
Electronic Array	0	3,225	1,490	2,228	0	0
Eurotechnique	0	0	0	0	0	85
Fairchild	0	108	2,086	8,712	22,605	2,643
Fujitsu	0	1,935	2,194	17,662	46,924	27,344
General Instrument	0	0	0	0	0	0
Goldstar	0	0	0	0	0	0
Hitachi	0	0	757	21,879	46,292	39,903
Hyundai	0	0	0	0	0	0
Intel	7,981	46,337	54,517	103,179	116,247	94,240
Matsushita	0	0	0	0	1,757	2,405
Microchip Tech., Inc.	0	0	0	0	0	0
Mitsubishi	0	0	4,470	9,416	22,551	18,605
Mostek	0	0	541	15,641	13,274	9,694
Motorola	0	1,505	9,761	35,418	32,572	17,736
National	0	3,225	9,313	25,363	27,033	13,229
NEC	0	0	0	93	9,696	14,076
Oki	0	0	0	0	0	1,465
Ricoh	0	0	0	0	0	0
Rockwell	0	0	0	0	0	0
Seeq	0	0	0	0	0	0
Seiko-Epson	0	0	0	0	0	0
SGS	0	0	0	0	17,617	551
Sharp	0	0	0	0	0	0
Signetics	0	0	0	0	0	0
Synertek	0	0	0	0	2,294	0
Texas Instruments	416	7,789	34,422	114,314	122,319	66,619
Thomson	0	0	0	0	0	0
Toshiba	2,328	15,050	406	8,791	15,802	4,651
VLSI Technology	0	0	0	0	0	0
WaferScale	0	0	0	0	0	28
Others	0	0	0	0	0	0
Total	10,725	79,174	123,570	379,600	514,210	326,316

(Continued)

MOS EPROM--Market Shares

Table 2 (Continued)

MOS EPROM Market Shares (Dollarized Unit Shares in Thousands)

<u>Company</u>	<u>1982</u>	<u>1983</u>	<u>1984</u>	<u>1985</u>	<u>1986</u>	<u>1987</u>
AMD	37,554	76,917	138,358	99,233	73,727	114,210
Atmel	0	0	0	0	0	0
Cypress	0	0	0	0	0	3,492
Electronic Array	0	0	0	0	0	0
Eurotechnique	7,459	7,726	0	0	0	0
Fairchild	119	0	0	0	0	0
Fujitsu	65,979	98,288	145,799	107,320	77,782	156,150
General Instrument	0	0	0	280	22,425	0
Goldstar	0	0	0	0	13	60
Hitachi	65,784	129,933	229,915	135,901	145,981	140,009
Hyundai	0	0	0	0	13	120
Intel	150,996	206,824	210,516	155,099	210,096	255,892
Matsushita	2,318	1,276	420	277	327	0
Microchip Tech, Inc.	0	0	0	0	0	45,762
Mitsubishi	53,524	82,353	175,131	91,387	128,918	136,247
Mostek	3,708	1,755	0	0	0	0
Motorola	10,221	9,424	15,022	3,976	2,817	1,247
National	24,365	47,612	55,892	25,604	18,091	63,556
NEC	54,412	73,322	76,205	80,107	84,598	69,691
Oki	4,803	6,735	12,866	4,095	46	43,955
Ricoh	0	0	1,218	4,262	1,225	1,082
Rockwell	0	100	0	0	0	0
Seeg	174	8,145	40,831	13,947	8,640	5,526
Seiko-Epson	0	0	0	0	1,125	1,695
SGS	3,999	10,963	23,367	30,175	28,028	79,089
Sharp	0	0	0	0	172	1,435
Signetics	0	0	155	0	53	7,553
Synertek	0	0	0	0	0	0
Texas Instruments	42,334	98,587	138,643	55,749	38,868	83,920
Thomson	0	0	7,752	8,359	2,664	0
Toshiba	15,200	19,349	46,883	49,502	62,677	132,682
VLSI Technology	0	0	0	770	1,563	2,058
WaferScale	177	0	0	0	0	1,485
Others	0	0	648	264	340	0
Total	542,949	879,309	1,319,621	866,335	910,366	1,346,916

Note: Columns may not add to totals shown because of rounding.

Source: Dataquest
June 1988

MOS EPROM--Market Shares

Table 3

MOS EPROM Regional Shares (Percentages)

<u>Regional Shares</u>	<u>1976</u>	<u>1977</u>	<u>1978</u>	<u>1979</u>	<u>1980</u>	<u>1981</u>
United States	77.8%	76.7%	92.0%	87.5%	71.5%	66.3%
Japan	22.2	23.3	8.0	12.5	25.5	33.4
Europe	0	0	0	0	2.9	0.3
Korea	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

<u>Regional Shares</u>	<u>1982</u>	<u>1983</u>	<u>1984</u>	<u>1985</u>	<u>1986</u>	<u>1987</u>
United States	51.9%	48.5%	46.4%	39.9%	39.9%	44.5%
Japan	45.1	48.5	50.0	54.2	55.5	47.4
Europe	3.1	3.0	3.6	5.9	4.6	8.0
Korea	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Note: Columns may not add to totals shown because of rounding.

Source: Dataquest
June 1988

MOS EPROM--Market Shares

Table 4

MOS EPROM Regional Shares (Dollarized Unit Shares in Thousands)

<u>Regional Shares</u>	<u>1976</u>	<u>1977</u>	<u>1978</u>	<u>1979</u>	<u>1980</u>	<u>1981</u>
United States	8,397	62,189	115,743	321,759	353,571	217,231
Japan	2,328	16,985	7,827	57,841	143,022	108,449
Europe	0	0	0	0	17,617	636
Korea	0	0	0	0	0	0
Total	10,725	79,174	123,570	379,600	514,210	326,316

<u>Regional Shares</u>	<u>1982</u>	<u>1983</u>	<u>1984</u>	<u>1985</u>	<u>1986</u>	<u>1987</u>
United States	269,471	449,364	600,065	354,950	376,797	577,148
Japan	262,020	411,256	688,437	472,851	502,851	682,946
Europe	11,458	18,689	31,119	38,534	30,692	86,642
Korea	0	0	0	0	26	180
Total	542,949	879,309	1,319,621	866,335	910,366	1,346,916

Note: Columns may not add to totals shown because of rounding.

Source: Dataquest
June 1988

MOS EPROM--Market Shares

Table 5

MOS EPROM Top 10 Shares (Percentages)

<u>Top 5 and 10 Shares</u>	<u>1978</u>	<u>1979</u>	<u>1980</u>	<u>1981</u>	<u>1982</u>
Top 5	91.0%	79.1%	70.9%	75.6%	72.0%
United States	87.4%	73.3%	52.7%	49.3%	27.8%
Japan	3.6%	5.8%	18.1%	26.3%	44.1%
Europe	0	0	0	0	0
Korea	0	0	0	0	0
Next 5	8.2%	18.0%	20.0%	20.8%	23.9%
United States	5.8%	10.9%	15.6%	16.5%	21.1%
Japan	2.4%	7.1%	4.4%	4.3%	2.8%
Europe	0	0	0	0	0
Korea	0	0	0	0	0
Top 10	99.2%	97.1%	90.8%	96.4%	95.8%
United States	93.2%	84.2%	68.3%	65.8%	48.9%
Japan	6.0%	12.9%	22.5%	30.6%	46.9%
Europe	0	0	0	0	0
Korea	0	0	0	0	0
<u>Top 5 and 10 Shares</u>	<u>1983</u>	<u>1984</u>	<u>1985</u>	<u>1986</u>	<u>1987</u>
Top 5	60.9%	68.2%	68.0%	71.1%	61.0%
United States	34.9%	26.5%	29.4%	23.1%	19.0%
Japan	26.0%	41.7%	38.6%	48.0%	42.0%
Europe	0	0	0	0	0
Korea	0	0	0	0	0
Next 5	25.9%	27.1%	27.8%	24.8%	30.5%
United States	14.2%	17.8%	9.4%	14.8%	19.4%
Japan	10.5%	9.3%	15.0%	6.9%	5.2%
Europe	1.2%	0	3.5%	3.1%	5.9%
Korea	0	0	0	0	0
Top 10	86.8%	95.3%	95.8%	95.9%	91.4%
United States	49.1%	44.3%	38.7%	37.9%	38.4%
Japan	36.5%	51.1%	53.6%	54.9%	47.1%
Europe	1.2%	0	3.5%	3.1%	5.9%
Korea	0	0	0	0	0

Note: Columns may not add to totals shown because of rounding.

Source: Dataquest
June 1988

MOS EPROM--Market Shares

Table 6
8K EPROM Market Shares
(Percentages)

<u>Company</u>	<u>1976</u>	<u>1977</u>	<u>1978</u>	<u>1979</u>	<u>1980</u>
AMD	0	0	5.0%	12.3%	14.8%
Electronic Array	0	5.1%	2.1	1.6	0
Fairchild	0	0.2	2.9	6.4	20.6
Fujitsu	0	3.1	2.9	1.1	1.3
Intel	75.0%	55.0	35.2	24.6	12.5
Mitsubishi	0	0	6.2	4.6	2.5
Motorola	0	2.4	10.6	16.9	10.3
National	0	5.1	12.9	15.2	21.2
Oki	0	0	0	0	0
Texas Instruments	2.0	5.1	21.8	15.7	16.6
Toshiba	<u>23.0</u>	<u>24.0</u>	<u>0.4</u>	<u>1.5</u>	<u>0.2</u>
Total	100.0%	100.0%	100.0%	100.0%	100.0%

<u>Company</u>	<u>1981</u>	<u>1982</u>	<u>1983</u>	<u>1984</u>	<u>1985</u>	<u>1986</u>
AMD	18.1%	23.2%	20.3%	91.0%	100.0%	100.0%
Electronic Array	0	0	0	0	0	0
Fairchild	12.3	1.9	0	0	0	0
Fujitsu	1.3	0	0	0	0	0
Intel	8.3	1.1	0	0	0	0
Mitsubishi	3.4	3.5	0	0	0	0
Motorola	11.5	41.0	19.6	0	0	0
National	17.4	11.9	10.1	9.0	0	0
Oki	3.6	5.1	0	0	0	0
Texas Instruments	24.0	12.4	50.0	0	0	0
Toshiba	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Note: Columns may not add to totals shown because of rounding.

Source: Dataquest
June 1988

MOS EPROM--Market Shares

Table 7

16K EPROM Market Shares (Percentages)

Company	1976	1977	1978	1979	1980	1981
AMD	0	0	0	0.1%	1.1%	4.1%
Cypress	0	0	0	0	0	0
Eurotechnique	0	0	0	0	0	0
Fairchild	0	0	0	0	2.9	0.3
Fujitsu	0	0	0.2%	7.5	9.6	6.6
Hitachi	0	0	1.5	10.2	12.7	11.9
Intel	66.7%	72.3%	57.0	25.9	17.9	26.0
Matsushita	0	0	0	0	0.6	1.6
Mitsubishi	0	0	0	1.5	3.7	5.6
Mostek	0	0	1.1	7.3	4.3	6.3
Motorola	0	0	4.2	5.8	5.2	3.9
National	0	0	0	2.2	4.0	6.4
NEC	0	0	0	0.0	0.7	4.3
Oki	0	0	0	0	0	0.5
SGS	0	0	0	0	5.9	0.4
Synertek	0	0	0	0	0.8	0
Texas Instruments	33.3	27.7	35.9	36.3	26.3	20.4
Thomson	0	0	0	0	0	0
Toshiba	0	0	0.2	3.2	4.5	1.7
WaferScale	0	0	0	0	0	0
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Company	1982	1983	1984	1985	1986	1987
AMD	9.8%	7.8%	12.4%	21.0%	20.0%	15.3%
Cypress	0	0	0	0	0	9.2
Eurotechnique	3.7	1.7	0	0	0	0
Fairchild	0	0	0	0	0	0
Fujitsu	2.6	0.2	0	0	0	0
Hitachi	2.6	0.5	0	0	0	0
Intel	19.8	7.6	1.6	0	8.2	8.1
Matsushita	1.8	0.9	0.3	0	0	0
Mitsubishi	2.9	1.3	1.3	0.4	0	0
Mostek	2.8	1.2	0	0	0	0
Motorola	1.3	0.3	0	0	0	0
National	15.3	26.0	33.0	28.1	36.4	8.0
NEC	10.0	18.9	11.3	6.2	3.9	2.0
Oki	3.4	3.3	2.4	1.8	0	0
SGS	2.7	6.5	7.4	13.9	12.6	46.0
Synertek	0	0	0	0	0	0
Texas Instruments	17.7	22.8	27.7	22.4	18.8	11.0
Thomson	0	0	2.6	6.2	0	0
Toshiba	3.5	1.1	0	0	0	0
WaferScale	0	0	0	0	0	2.0
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Note: Columns may not add to totals shown because of rounding.

Source: Dataquest
June 1988

MOS EPROM--Market Shares

Table 8

32K EPROM Market Shares (Percentages)

<u>Company</u>	<u>1978</u>	<u>1979</u>	<u>1980</u>	<u>1981</u>	<u>1982</u>
AMD	0	3.3%	7.0%	3.3%	7.0%
Eurotechnique	0	0	1.1	0	1.1
Fujitsu	7.6%	11.8	7.8	11.8	7.8
Hitachi	13.0	18.7	19.9	18.7	19.9
Intel	50.8	24.2	21.0	24.2	21.0
Mitsubishi	0	8.5	13.8	8.5	13.8
Mostek	0.7	0	0	0	0
Motorola	8.8	4.7	1.2	4.7	1.2
National	0	0.6	1.4	0.6	1.4
NEC	0	6.8	16.4	6.8	16.4
Ricoh	0	0	0	0	0
SGS	0	0	0.2	0	0.2
Texas Instruments	19.2	19.4	6.0	19.4	6.0
Thomson-Eurotechnique	0	0	0	0	0
Toshiba	0	1.9	4.2	1.9	4.2
Others	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total	100.0%	100.0%	100.0%	100.0%	100.0%

<u>Company</u>	<u>1983</u>	<u>1984</u>	<u>1985</u>	<u>1986</u>	<u>1987</u>
AMD	7.2%	13.3%	20.0%	13.3%	12.1%
Eurotechnique	2.1	0	0	0	0
Fujitsu	9.4	12.0	7.4	1.2	0
Hitachi	20.9	12.3	6.2	3.9	0
Intel	14.5	13.0	16.4	27.8	27.8
Mitsubishi	9.8	5.2	6.8	3.9	0
Mostek	0	0	0	0	0
Motorola	0	0	0	0	0
National	3.5	6.6	6.0	6.0	17.6
NEC	13.4	8.0	6.6	3.5	0.9
Ricoh	0	0.3	1.8	0.5	0
SGS	0.6	3.7	8.7	14.9	15.3
Texas Instruments	15.3	22.6	15.8	19.5	26.3
Thomson-Eurotechnique	0	2.1	4.0	5.6	0
Toshiba	3.2	0.9	0	0	0
Others	<u>0</u>	<u>0.1</u>	<u>0.3</u>	<u>0</u>	<u>0</u>
Total	100.0%	100.0%	100.0%	100.0%	100.0%

Note: Columns may not add to totals shown because of rounding.

Source: Dataquest
June 1988

MOS EPROM--Market Shares

Table 9

64K EPROM Market Shares (Percentages)

<u>Company</u>	<u>1980</u>	<u>1981</u>	<u>1982</u>	<u>1983</u>	<u>1984</u>	<u>1985</u>	<u>1986</u>	<u>1987</u>
AMD	0	0	4.2%	7.0%	5.9%	6.6%	3.6%	8.0%
Cypress	0	0	0	0	0	0	0	0.4
Fujitsu	7.6%	8.5%	28.0	18.2	14.2	18.1	17.2	15.0
General Instrument	0	0	0	0	0	0	0.2	0
Goldstar	0	0	0	0	0	0	0	0
Hitachi	13.0	2.3	9.7	19.8	22.3	21.8	21.9	9.5
Hyundai	0	0	0	0	0	0	0	0.1
Intel	50.8	57.0	41.4	21.5	8.1	11.9	15.6	13.0
Microchip Tech., Inc.	0	0	0	0	0	0	0	2.0
Mitsubishi	0	0	10.6	16.4	21.7	15.3	14.6	9.3
Mostek	0.7	0.7	0	0	0	0	0	0
Motorola	8.8	9.9	2.0	2.3	2.9	1.4	1.1	0.6
National	0	0	0	0	0	0	0.5	8.0
NEC	0	0	1.5	3.0	4.4	7.0	6.5	3.4
Okidata	0	0	0	0.6	1.9	1.0	0	2.5
Ricoh	0	0	0	0	0.1	0.8	0.4	0.4
Seeq	0	0	0.1	1.6	4.0	1.7	1.6	1.1
Seiko-Epson	0	0	0	0	0	0	0.3	0.5
SGS	0	0	0	0	1.2	4.0	6.2	10.0
Texas Instruments	19.2	21.6	2.2	7.2	10.3	8.1	6.5	7.0
Toshiba	0	0	0.4	2.5	2.9	2.2	3.6	8.1
VLSI Technology	0	0	0	0	0	0.1	0.2	0.5
WaferScale	0	0	0	0	0	0	0	0.2
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Note: Columns may not add to totals shown because of rounding.

Source: Dataquest
June 1988

MOS EPROM--Market Shares

Table 10

128K EPROM Market Shares (Percentages)

<u>Company</u>	<u>1982</u>	<u>1983</u>	<u>1984</u>	<u>1985</u>	<u>1986</u>	<u>1987</u>
AMD	0	15.8%	10.2%	6.9%	7.4%	12.0%
Fujitsu	0	8.6	10.5	11.9	9.3	13.0
General Instrument	0	0	0	0	0.3	0
Hitachi	0	8.6	24.2	22.9	18.5	10.0
Intel	95.6%	60.9	23.4	14.3	20.7	18.0
Matsushita	0	0	0	0.1	0.1	0
Microchip Tech., Inc.	0	0	0	0	0	3.0
Mitsubishi	0	0.5	13.9	17.2	17.3	10.0
National	0	0	0	0	0	2.0
NEC	0	2.0	6.0	15.1	14.3	4.0
Okii	0	0	0	0	0	4.0
SGS-Thomson	0	0	0	0	0	6.0
Seeq	0	2.3	5.5	2.1	1.9	1.0
Seiko-Epson	0	0	0	0	1.0	0
Texas Instruments	4.4	0	0.3	0.2	1.2	7.0
Toshiba	0	1.2	6.0	9.3	8.9	11.0
VLSI Technology	0	0	0	0	0.1	0
WaferScale	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Note: Columns may not add to totals shown because of rounding.

Source: Dataquest
June 1988

MOS EPROM—Market Shares

Table 11
256K EPROM Market Shares
(Percentages)

<u>Company</u>	<u>1983</u>	<u>1984</u>	<u>1985</u>	<u>1986</u>	<u>1987</u>
AMD	17.5%	25.9%	14.5%	5.9%	6.0%
Fujitsu	12.5	9.2	12.3	4.7	9.0
General Instrument	0	0	0.2	6.4	0
Hitachi	0	0	9.3	10.7	11.0
Intel	70.0	55.8	37.0	28.2	21.0
Microchip Tech., Inc.	0	0	0	0	6.0
Mitsubishi	0	0.2	1.4	18.0	11.0
National	0	0	0	1.0	6.0
NEC	0	0.2	9.0	13.0	6.0
Oki	0	0	0	0	3.0
Ricoh	0	0	0	0	0
Seeq	0	0.2	2.6	0.3	0
Seiko-Epson	0	0	0	0	0
SGS-Thomson	0	0	0	0.2	4.0
Signetics	0	0	0	0	1.0
Texas Instruments	0	0	0.2	1.6	6.0
Toshiba	0	8.5	13.0	9.5	12.0
VLSI Technology	0	0	0	0.3	0
WaferScale	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total	100.0%	100.0%	100.0%	100.0%	100.0%

Note: Columns may not add to totals shown because of rounding.

Source: Dataquest
June 1988

MOS EPROM---Market Shares

Table 12

512K EPROM Market Shares (Percentages)

<u>Company</u>	<u>1984</u>	<u>1985</u>	<u>1986</u>	<u>1987</u>
AMD	50.0%	34.3%	28.6%	10.0%
Fujitsu	0	2.3	1.7	19.0
General Instrument	0	0	2.4	0
Hitachi	0	3.4	13.3	11.0
Intel	50.0	60.0	38.8	21.0
Microchip Tech., Inc.	0	0	0	2.0
Mitsubishi	0	0	4.2	14.0
National	0	0	0.3	0
NEC	0	0	0	3.0
Oki	0	0	0	6.0
SGS-Thomson	0	0	0	1.0
Texas Instruments	0	0	0	3.0
Toshiba	0	0	10.3	10.0
VLSI Technology	0	0	0.1	0
WaferScale	<u>0</u>	<u>0</u>	<u>0.3</u>	<u>0</u>
Total	100.0%	100.0%	100.0%	100.0%

Note: Columns may not add to totals shown because of rounding.

Source: Dataquest
June 1988

MOS EPROM--Market Shares

Table 13

1-Mbit EPROM Market Shares (Percentages)

<u>Company</u>	<u>1986</u>	<u>1987</u>
AMD	4.1%	6.0%
Fujitsu	0.3	1.0
Hitachi	71.4	29.0
Intel	17.0	19.0
Microchip Tech., Inc.	0	0
Mitsubishi	0	5
National	0	0
NEC	0.3	31.0
Oki	0	0
SGS-Thomson	0	0
Texas Instrument	0	0
Toshiba	<u>6.8</u>	<u>9.0</u>
Total	100.0%	100.0%

Note: Columns may not add to totals shown
because of rounding.

Source: Dataquest
June 1988

MARKET SHARE HIGHLIGHTS--1987

A major highlight of 1987 was that the Japanese revenue share of the total MOS EPROM market dropped to 47.4 percent in 1987, from 55.5 percent in 1986, which was an evident break from history. Dataquest believes that this can be directly attributed to MITI's enforced production cutback guidelines for memory suppliers, a result of further U.S.-Japan Trade Agreement discussions.

Other highlights of this market share analysis include:

- Regionally, U.S. EPROM manufacturers gained revenue share. While Intel maintained its lead over all suppliers worldwide, increases were seen in the overall revenue shares of AMD, National, and Texas Instruments. European market share also increased substantially to 8.0 percent from 4.6 percent in 1986.

MOS EPROM--Market Shares

- The EPROM market continues to be dominated by the top five vendors. However, while the top five maintained 61.0 percent of the total revenue share, down from 71.1 percent in 1986, the next five vendors boosted their worldwide share to 30.5 percent, up from 24.8 percent.
- The top ten regional suppliers continue to maintain more than 90 percent revenue share of the worldwide EPROM market. However, after three years of increasing shares, the top ten suppliers' share dropped to 91.4 percent in 1987, from 95.9 percent in 1986. Although the EPROM market grew in both units and revenue in 1987, a shift is now occurring in vendor share.

DATAQUEST ANALYSIS

In order to understand the Japanese challenge to U.S. EPROM suppliers, the following scenario of events must be reviewed. In the early 1970s, Japanese manufacturers took several corrective actions to increase their competitive stature in the semiconductor industry:

<u>Problem</u>	<u>Action</u>
Slow response to consumer demand for new products	Imported CAD equipment to speed up design process
Rising labor costs and poor wire bonding	Automated equipment
Low yields	Instituted high-volume production and quality control

Their objective was to reduce prices through learning-curve effects and economies of scale, and this strategy was effective. Japanese producers captured 50 percent of total Japanese sales of LSI calculators in 1972 and 65 percent in 1973. Although domestic demand still relied on foreign imports, Japanese manufacturers began exporting ICs in 1973.

In July 1975, NTT (Nippon Telegraph and Telephone) and MITI (Ministry of International Trade and Industry) agreed to a joint research project; they formed the VLSI Technology Research Association in March 1976. The four-year program was budgeted at ¥70 billion (about \$300 million) and consisted of the two government

MOS EPROM--Market Shares

agencies plus Fujitsu, Hitachi, Mitsubishi, NEC, and Toshiba. The goal was to develop basic VLSI technology and manufacturing techniques for use in computers. The following six research items were targeted for development:

- Microfabrication technology to handle submicron lithography
 - Electron-beam technology
 - X-ray technology
- Low-defect, large-diameter silicon wafer substrates
- Improved computer-aided design (CAD) technology
- LSI microfabrication process techniques and equipment
- VLSI evaluation and testing techniques and equipment
- Logic and memory devices using the above technologies

The results of the VLSI project are dramatically visible in three areas: scientific papers and patents, entry of Japanese companies into memory markets, and overall production and market share of the participating companies.

The VLSI project has been crucial in pushing Japanese companies into areas of innovative research. By 1980, more than 1,000 new VLSI patents had been developed from this project. Of even greater import has been the rapid entry of Japanese companies into the DRAM, EPROM, and ROM markets.

Despite a worldwide recession, shipments of Japanese EPROMs grew rapidly in 1982, increasing their share of the worldwide market to more than 45 percent, up from 33 percent in 1981. The Japanese became formidable contenders in the commodity EPROM market as a result of the yen appreciation from 1984 to 1986; aggressive pricing tactics; and new entrants to the market, including Seiko-Epson, Matsushita, and Sharp.

The market share tables in this section illustrate how regional shares of the EPROM market have changed through the years. It is clearly evident through Intel's performance that market share leadership is gained from an early lead in technology--in being first at the next density. The tables also show us a potential for change in the future market share profile.

During the last two years, we have seen EPROM suppliers seeking and developing strategic alliances, innovative products, and new applications. Strategies such as these can offset the tremendous competition yet to come in the EPROM market. Dataquest believes that the main source of growth and change will be an expansion in demand for high-performance CMOS memory products, which will gain share at the expense of older bipolar and NMOS components.

MOS EPROM--Market Share

OVERVIEW OF MARKET SHARES

An integral part of Dataquest's MOS EPROM forecast is analyzing the EPROM market by gathering shipment data from each EPROM manufacturer. The data and end analysis provide insights into the EPROM market and reinforce estimates of consumption, production and company revenue. The information in this section should be interpreted as follows:

- Overall market shares are based on all "dollarized" unit shipments. Each density's units are multiplied by that density's overall average selling price (ASP) for the year. All density dollar values are then added to arrive at each company's total estimated MOS EPROM market share for the specific year.
- The totals for all companies reflect worldwide production. Although these numbers are in dollars, they do not relate to a company's true EPROM revenue, as worldwide ASPs can vary by region, technology, density, package type, or application.

We believe that the estimates presented here are the most accurate and meaningful generally available today. The EPROM data presented in the tables were derived from interviews with knowledgeable manufacturers and users.

MOS EPROM—MARKET SHARE

The following market share estimates provide a historical view of data from 1976 through 1988. The 1988 data were gathered prior to year-end 1988 and, hence, are subject to revision. The following tables cover market shares in terms of units, dollars, and percent of units for all MOS EPROM densities:

- Table 1—EPROM Market Shares (Percent of Units)
- Table 2—EPROM Market Shares (Dollarized Unit Shares in Thousands)
- Table 3—EPROM Regional Shares (Percent of Units)
- Table 4—EPROM Regional Shares (Dollarized Unit Shares in Thousands)
- Table 5—EPROM Top 10 Shares (Percentages)
- Table 6—8K EPROM Market Shares (Percentages)
- Table 7—16K EPROM Market Shares (Percentages)
- Table 8—32K EPROM Market Shares (Percentages)

MOS EPROM--Market Share

- Table 9—64K EPROM Market Shares (Percentages)
- Table 10—128K EPROM Market Shares (Percentages)
- Table 11—256K EPROM Market Shares (Percentages)
- Table 12—512K EPROM Market Shares (Percentages)
- Table 13—1Mb EPROM Market Shares (Percentages)
- Table 14—2Mb EPROM Market Shares (Percentages)
- Table 15—4Mb EPROM Market Shares (Percentages)

Historical highlights of the overall EPROM market include the following:

- Regionally, U.S. EPROM suppliers slowly lost market share from 1976 through 1981. In 1976, Intel dominated the market with 78 percent of the worldwide EPROM market. From 1978 through 1981, Intel and Texas Instruments dominated the worldwide EPROM market. By 1986, Intel was leading the market again, followed by Hitachi and Mitsubishi.
- Japanese suppliers made their largest gains in EPROM market share from 1984 through 1986. By dominating the 64K and 128K EPROM sectors, they boosted their worldwide share to 50 percent. By 1986, they had captured 55.5 percent of the worldwide EPROM market. As MITI enforced production cutback guidelines for memory suppliers Japanese revenue share of MOS EPROM revenue dropped to 47.4 percent in 1987, and to 32.8 percent in 1988.
- The EPROM market has always been heavily concentrated in the top five vendors. Despite the fact that the companies at the top have changed through the years, their shares have consistently averaged more than 60.0 percent of the market, until 1988 when the shares for the top five vendors dropped to 56.3 percent.

MARKET SHARE HIGHLIGHTS—1988

For a second consecutive year, the Japanese revenue share of the total MOS EPROM market dropped to 32.8 percent in 1988 from 47.4 percent in 1987. Dataquest believes that this can be attributed to MITI's continued monitoring of production by memory suppliers, but also a result of the Japanese supplier shift of production capacity over to MOS DRAMs.

MOS EPROM--Market Share

Other highlights of this market share analysis include:

- Regionally, U.S. EPROM manufacturers gained revenue share in the 16K through 512K densities, with marginal gain in the 1Mb product area. Intel continued to lead the market with an estimated 18 percent worldwide share. However, the greatest gain in overall share was made by SGS-Thomson in Europe. Fujitsu, Mitsubishi, and AMD followed Intel and SGS-Thomson as the top five vendors during 1988.
- Although the top five vendors averaged 56.3 percent share of the total market, the next five vendors continued to boost their worldwide share to 33.3 percent up from 29.7 percent in 1987.
- The top 10 regional supplier share dropped to 89.6 percent, after four years of maintaining more than 90 percent of total worldwide share. A continued shift in vendor revenue and unit share is expected to continue through 1989 and 1990.

HISTORICAL ANALYSIS

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MOS EPROM--Market Share

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 - Electron-beam technology
 - X-ray technology
- Low-defect, large-diameter silicon wafer substrates
- Improved computer-aided design (CAD) technology
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The market share tables in this section illustrate how regional shares of the EPROM market have changed through the years. It is clearly evident through Intel's performance that market share leadership is gained from an early lead in technology—in being first at the next density. The tables also show us a potential for change in the future market share profile.

MOS EPROM--Market Share

During the 1986 through 1988 time frame, EPROM suppliers developed strategic alliances, innovative products, and new applications to offset the tremendous competition that developed among 23 suppliers. The main source of growth in vendor share in the future is expected to come from those companies that expand their product emphasis into the high-performance and high-density CMOS EPROM products.

MOS EPROM--Market Share

Table 1
MOS EPROM Market Shares
(Percentages)

Company	1976	1977	1978	1979	1980	1981
AMD	0	0	3%	4%	3%	4%
Atmel	0	0	0	0	0	0
Catalyst	0	0	0	0	0	0
Cypress	0	0	0	0	0	0
Electronic Array	0	4%	1	1	0	0
Eurotechnique	0	0	0	0	0	0
Fairchild	0	0	2	2	4	1
Fujitsu	0	2	2	5	9	8
General Instrument	0	0	0	0	0	0
GoldStar	0	0	0	0	0	0
Hitachi	0	0	1	6	9	12
Hyundai	0	0	0	0	0	0
Intel	74%	59	44	27	23	29
Matsushita	0	0	0	0	0	1
Microchip Tech., Inc.	0	0	0	0	0	0
Mitsubishi	0	0	4	2	4	6
Mostek	0	0	0	4	3	3
Motorola	0	2	8	9	6	5
National	0	4	8	7	5	4
NEC	0	0	0	0	2	4
Ok!	0	0	0	0	0	0
Ricoh	0	0	0	0	0	0
Rockwell	0	0	0	0	0	0
SEEQ	0	0	0	0	0	0
Seiko-Epson	0	0	0	0	0	0
SGS	0	0	0	0	3	0
Sharp	0	0	0	0	0	0
Signetics	0	0	0	0	0	0
Synertek	0	0	0	0	0	0
Texas Instruments	4	10	28	30	24	20
Thomson	0	0	0	0	0	0
Toshiba	22	19	0	2	3	1
VLSI Technology	0	0	0	0	0	0
WaferScale	0	0	0	0	0	0
Others	0	0	0	0	0	0
Total	100%	100%	100%	100%	100%	100%

(Continued)

MOS EPROM--Market Share

Table 1 (Continued)
MOS EPROM Market Shares
(Percentages)

Company	1982	1983	1984	1985	1986	1987
AMD	7%	9%	10%	11%	8%	8%
Atmel	0	0	0	0	0	0
Catalyst	0	0	0	0	0	0
Cypress	0	0	0	0	0	0
Electronic Array	0	0	0	0	0	0
Eurotechnique	1	1	0	0	0	0
Fairchild	0	0	0	0	0	0
Fujitsu	12	11	11	12	9	11
General Instrument	0	0	0	0	2	0
GoldStar	0	0	0	0	0	0
Hitachi	12	15	17	16	16	10
Hyundai	0	0	0	0	0	0
Intel	28	24	16	18	23	18
Intel	0	0	0	0	0	0
Matsushita	0	0	0	0	0	0
Microchip Tech., Inc.	0	0	0	0	0	3
Mitsubishi	10	9	13	11	14	9
Mostek	1	0	0	0	0	0
Motorola	2	1	1	0	0	0
National	4	5	4	3	2	6
NEC	10	8	6	9	9	4
OkI	1	1	1	0	0	2
Ricoh	0	0	0	0	0	0
Rockwell	0	0	0	0	0	0
SEEQ	0	1	3	2	1	1
Seiko-Epson	0	0	0	0	0	0
SGS	1	1	2	3	3	7
Sharp	0	0	0	0	0	0
Signetics	0	0	0	0	0	1
Synertek	0	0	0	0	0	0
Texas Instruments	8	11	11	6	4	7
Thomson	0	0	1	1	0	0
Toshiba	3	2	4	6	7	10
VLSI Technology	0	0	0	0	0	0
WaferScale	0	0	0	0	0	0
Others	0	0	0	0	0	0
Total	100%	100%	100%	100%	100%	100%

(Continued)

MOS EPROM--Market Share

Table 1 (Continued)

MOS EPROM Market Shares (Percentages)

<u>Company</u>	<u>1988</u>
AMD	9%
Atmel	0
Catalyst	0
Cypress	0
Fujitsu	8
GoldStar	0
Hitachi	2
Hyundai	0
ICT	0
Intel	18
Microchip Tech., Inc.	6
Mitsubishi	8
Motorola	0
National	8
NEC	4
Oki	2
Ricoh	0
SEEQ	0
Seiko-Epson	0
SGS-Thomson	13
Sharp	0
Signetics	3
Texas Instruments	9
Toshiba	8
VLSI Technology	0
WaferScale	<u>1</u>
Total	100%

Note: Columns may not add to totals .
shown because of rounding.

Source: Dataquest
September 1989

MOS EPROM--Market Share

Table 2

MOS EPROM Market Shares
(Dollalized Unit Shares in Thousands)

Company	1976	1977	1978	1979	1980	1981
AMD	0	0	3,613	16,904	17,227	13,070
Atmel	0	0	0	0	0	0
Cypress	0	0	0	0	0	0
Electronic Array	0	3,225	1,490	2,228	0	0
Eurotechnique	0	0	0	0	0	85
Fairchild	0	108	2,086	8,712	22,605	2,643
Fujitsu	0	1,935	2,194	17,662	46,924	27,344
General Instrument	0	0	0	0	0	0
GoldStar	0	0	0	0	0	0
Hitachi	0	0	757	21,879	46,292	39,903
Hyundai	0	0	0	0	0	0
Intel	7,981	46,337	54,517	103,179	116,247	94,240
Matsushita	0	0	0	0	1,757	2,405
Microchip Tech., Inc.	0	0	0	0	0	0
Mitsubishi	0	0	4,470	9,416	22,551	18,605
Mostek	0	0	541	15,641	13,274	9,694
Motorola	0	1,505	9,761	35,418	32,572	17,736
National	0	3,225	9,313	25,363	27,033	13,229
NEC	0	0	0	93	9,696	14,076
OkI	0	0	0	0	0	1,465
Ricoh	0	0	0	0	0	0
Rockwell	0	0	0	0	0	0
SEEG	0	0	0	0	0	0
Seiko-Epson	0	0	0	0	0	0
SGS	0	0	0	0	17,617	551
Sharp	0	0	0	0	0	0
Signetics	0	0	0	0	0	0
Synertek	0	0	0	0	2,294	0
Texas Instruments	416	7,789	34,422	114,314	122,319	66,619
Thomson	0	0	0	0	0	0
Toshiba	2,328	15,050	406	8,791	15,802	4,651
VLSI Technology	0	0	0	0	0	0
WaferScale	0	0	0	0	0	28
Others	0	0	0	0	0	0
Total	10,725	79,174	123,569	379,600	514,208	326,317

(Continued)

MOS EPROM--Market Share

Table 2 (Continued)

MOS EPROM Market Shares
(Dollarized Unit Shares in Thousands)

<u>Company</u>	<u>1982</u>	<u>1983</u>	<u>1984</u>	<u>1985</u>	<u>1986</u>	<u>1987</u>
AMD	37,554	76,917	138,358	99,233	73,727	108,468
Atmel	0	0	0	0	0	0
Cypress	0	0	0	0	0	3,495
Electronic Array	0	0	0	0	0	0
Eurotechnique	7,459	7,726	0	0	0	0
Fairchild	119	0	0	0	0	0
Fujitsu	65,979	98,288	145,799	107,320	77,782	158,985
General Instrument	0	0	0	280	22,425	0
GoldStar	0	0	0	0	13	510
Hitachi	65,784	129,933	229,915	135,901	145,981	143,682
Hyundai	0	0	0	0	13	120
Intel	150,996	206,824	210,516	155,099	210,096	256,261
Matsushita	2,318	1,276	420	277	327	0
Microchip Tech, Inc.	0	0	0	0	0	47,205
Mitsubishi	53,524	82,353	175,131	91,387	128,918	134,038
Mostek	3,708	1,755	0	0	0	0
Motorola	10,221	9,424	15,022	3,976	2,817	1,251
National	24,365	47,612	55,892	25,604	18,091	63,624
NEC	54,412	73,322	76,205	80,107	84,598	70,113
Oki	4,803	6,735	12,866	4,095	46	38,376
Ricoh	0	0	1,218	4,262	1,225	1,085
Rockwell	0	100	0	0	0	0
SEEQ	174	8,145	40,831	13,947	8,640	5,539
Seiko-Epson	0	0	0	0	1,125	1,699
SGS	3,999	10,963	23,367	30,175	28,028	79,161
Sharp	0	0	0	0	172	1,440
Signetics	0	0	155	0	53	13,901
Synertek	0	0	0	0	0	0
Texas Instruments	42,334	98,587	138,643	55,749	38,868	79,125
Thomson	0	0	7,752	8,359	2,664	0
Toshiba	15,200	19,349	46,883	49,502	62,677	138,197
VLSI Technology	0	0	0	770	1,563	2,062
WaferScale	0	0	0	28	177	1,487
Others	0	0	648	264	340	0
Total	542,947	879,305	1,319,619	866,333	910,367	1,349,822

(Continued)

MOS EPROM--Market Share

Table 2 (Continued)

MOS EPROM Market Shares
(Dollarized Unit Shares in Thousands)

<u>Company</u>	<u>1988</u>
AMD	\$ 160,377
Atmel	2,727
Catalyst	834
Cypress	6,832
Fujitsu	192,390
GoldStar	1,362
Hitachi	74,051
Hyundai	1,400
ICT	433
Intel	321,389
Microchip Tech., Inc.	100,348
Mitsubishi	177,160
Motorola	0
National	123,666
NEC	96,319
Oki	40,739
Ricoh	1,798
SEEQ	3,999
Seiko-Epson	2,783
SGS-Thomson	201,162
Sharp	2,917
Signetics	45,165
Texas Instruments	149,437
Toshiba	151,884
VLSI Technology	0
WaferScale	<u>9,271</u>
Total	\$1,868,444

Note: Columns may not add to totals
shown because of rounding.

Source: Dataquest
September 1989

MOS EPROM--Market Share

Table 3

MOS EPROM Regional Shares (Percentages)

<u>Regional Shares</u>	<u>1976</u>	<u>1977</u>	<u>1978</u>	<u>1979</u>	<u>1980</u>	<u>1981</u>
United States	77.8%	76.7%	92.0%	87.5%	71.5%	66.3%
Japan	22.2	23.3	8.0	12.5	25.5	33.4
Western Europe	0	0	0	0	2.9	0.3
South Korea	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

<u>Regional Shares</u>	<u>1982</u>	<u>1983</u>	<u>1984</u>	<u>1985</u>	<u>1986</u>	<u>1987</u>
United States	51.9%	48.5%	46.4%	39.9%	39.9%	43.9%
Japan	45.1	48.5	50.0	54.2	55.5	47.4
Western Europe	3.1	3.0	3.6	5.9	4.6	8.7
South Korea	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0.1</u>
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

<u>Regional Shares</u>	<u>1988</u>
United States	51.3%
Japan	32.8
Western Europe	15.6
South Korea	<u>0.2</u>
Total	100.0%

Note: Columns may not add to totals shown because of rounding.

Source: Dataquest
September 1989

MOS EPROM--Market Share

Table 4

MOS EPROM Regional Shares (Dollarized Unit Shares in Thousands)

<u>Regional Shares</u>	<u>1976</u>	<u>1977</u>	<u>1978</u>	<u>1979</u>	<u>1980</u>	<u>1981</u>
United States	8,397	62,189	115,742	321,759	353,571	217,231
Japan	2,328	16,985	7,827	57,841	143,020	108,450
Western Europe	0	0	0	0	17,617	636
South Korea	0	0	0	0	0	0
Total	10,725	79,174	123,569	379,600	514,208	326,317

<u>Regional Shares</u>	<u>1982</u>	<u>1983</u>	<u>1984</u>	<u>1985</u>	<u>1986</u>	<u>1987</u>
United States	269,471	449,362	600,065	354,950	376,798	568,516
Japan	262,018	411,254	688,435	472,849	502,851	687,615
Western Europe	11,458	18,689	31,119	38,534	30,692	93,062
South Korea	0	0	0	0	26	630
Total	542,947	879,305	1,319,619	866,333	910,367	1,349,822

<u>Regional Shares</u>	<u>1988</u>
United States	879,314
Japan	740,041
Western Europe	246,327
South Korea	2,762
Total	1,868,444

Note: Columns may not add to totals shown because of rounding.

Source: Dataquest
September 1989

MOS EPROM--Market Share

Table 5

MOS EPROM Top 10 Shares (Percentages)

<u>Top 5 and 10 Shares</u>	<u>1978</u>	<u>1979</u>	<u>1980</u>	<u>1981</u>	<u>1982</u>	
Top 5	91.0%	79.1%	70.9%	75.6%	72.0%	
United States	87.4%	73.3%	52.7%	49.3%	27.8%	
Japan	3.6%	5.8%	18.1%	26.3%	44.1%	
Western Europe	0	0	0	0	0	
South Korea	0	0	0	0	0	
Next 5	8.2%	18.0%	20.0%	20.8%	23.9%	
United States	5.8%	10.9%	15.6%	16.5%	21.1%	
Japan	2.4%	7.1%	4.4%	4.3%	2.8%	
Western Europe	0	0	0	0	0	
South Korea	0	0	0	0	0	
Top 10	99.2%	97.1%	90.8%	96.4%	95.8%	
United States	93.2%	84.2%	68.3%	65.8%	48.9%	
Japan	6.0%	12.9%	22.5%	30.6%	46.9%	
Western Europe	0	0	0	0	0	
South Korea	0	0	0	0	0	
 <u>Top 5 and 10 Shares</u>	 <u>1983</u>	 <u>1984</u>	 <u>1985</u>	 <u>1986</u>	 <u>1987</u>	 <u>1988</u>
Top 5	60.9%	68.2%	68.0%	71.1%	61.6%	56.3%
United States	34.9%	26.5%	29.4%	23.1%	19.0%	25.8%
Japan	26.0%	41.7%	38.6%	48.0%	42.6%	19.8%
Western Europe	0	0	0	0	0	10.8%
South Korea	0	0	0	0	0	0
Next 5	25.9%	27.1%	27.8%	24.8%	29.7%	33.3%
United States	14.2%	17.8%	9.4%	14.8%	18.6%	20.0%
Japan	10.5%	9.3%	15.0%	6.9%	5.2%	13.3%
Western Europe	1.2%	0	3.5%	3.1%	5.9%	0
South Korea	0	0	0	0	0	0
Top 10	86.8%	95.3%	95.8%	95.9%	91.2%	89.6%
United States	49.1%	44.3%	38.7%	37.9%	37.6%	45.8%
Japan	36.5%	51.1%	53.6%	54.9%	47.8%	0
Western Europe	1.2%	0	3.5%	3.1%	5.9%	33.1%
South Korea	0	0	0	0	0	10.8%

Note: Columns may not add to totals shown because of rounding.

Source: Dataquest
September 1989

MOS EPROM--Market Share

Table 6

8K EPROM Market Shares (Percentages)

<u>Company</u>	<u>1976</u>	<u>1977</u>	<u>1978</u>	<u>1979</u>	<u>1980</u>
AMD	0	0	5.0%	12.3%	14.8%
Electronic Array	0	5.1%	2.1	1.6	0
Fairchild	0	0.2	2.9	6.4	20.6
Fujitsu	0	3.1	2.9	1.1	1.3
Intel	75.0%	55.0	35.2	24.6	12.5
Mitsubishi	0	0	6.2	4.6	2.5
Motorola	0	2.4	10.6	16.9	10.3
National	0	5.1	12.9	15.2	21.2
Oki	0	0	0	0	0
Texas Instruments	2.0	5.1	21.8	15.7	16.6
Toshiba	<u>23.0</u>	<u>24.0</u>	<u>0.4</u>	<u>1.5</u>	<u>0.2</u>
Total	100.0%	100.0%	100.0%	100.0%	100.0%

<u>Company</u>	<u>1981</u>	<u>1982</u>	<u>1983</u>	<u>1984</u>	<u>1985</u>	<u>1986</u>
AMD	18.1%	23.2%	20.3%	91.0%	100.0%	100.0%
Electronic Array	0	0	0	0	0	0
Fairchild	12.3	1.9	0	0	0	0
Fujitsu	1.3	0	0	0	0	0
Intel	8.3	1.1	0	0	0	0
Mitsubishi	3.4	3.5	0	0	0	0
Motorola	11.5	41.0	19.6	0	0	0
National	17.4	11.9	10.1	9.0	0	0
Oki	3.6	5.1	0	0	0	0
Texas Instruments	24.0	12.4	50.0	0	0	0
Toshiba	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Note: Columns may not add to totals shown because of rounding.

Source: Dataquest
September 1989

MOS EPROM--Market Share

Table 7

16K EPROM Market Shares (Percentages)

<u>Company</u>	<u>1976</u>	<u>1977</u>	<u>1978</u>	<u>1979</u>	<u>1980</u>	<u>1981</u>
AMD	0	0	0	0.1%	1.1%	4.1%
Cypress	0	0	0	0	0	0
Eurotechnique	0	0	0	0	0	0
Fairchild	0	0	0	0	2.9	0.3
Fujitsu	0	0	0.2%	7.5	9.6	6.6
Hitachi	0	0	1.5	10.2	12.7	11.9
Intel	66.7%	72.3%	57.0	25.9	17.9	26.0
Matsushita	0	0	0	0	0.6	1.6
Mitsubishi	0	0	0	1.5	3.7	5.6
Mostek	0	0	1.1	7.3	4.3	6.3
Motorola	0	0	4.2	5.8	5.2	3.9
National	0	0	0	2.2	4.0	6.4
NEC	0	0	0	0.0	0.7	4.3
Ok1	0	0	0	0	0	0.5
SGS	0	0	0	0	5.9	0.4
Synertek	0	0	0	0	0.8	0
Texas Instruments	33.3	27.7	35.9	36.3	26.3	20.4
Thomson	0	0	0	0	0	0
Toshiba	0	0	0.2	3.2	4.5	1.7
WaferScale	0	0	0	0	0	0
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

<u>Company</u>	<u>1982</u>	<u>1983</u>	<u>1984</u>	<u>1985</u>	<u>1986</u>	<u>1987</u>
AMD	9.8%	7.8%	12.4%	21.0%	20.0%	14.3%
Cypress	0	0	0	0	0	9.3
Eurotechnique	3.7	1.7	0	0	0	0
Fairchild	0	0	0	0	0	0
Fujitsu	2.6	0.2	0	0	0	0
Hitachi	2.6	0.5	0	0	0	0
Intel	19.8	7.6	1.6	0	8.2	8.2
Matsushita	1.8	0.9	0.3	0	0	0
Mitsubishi	2.9	1.3	1.3	0.4	0	0
Mostek	2.8	1.2	0	0	0	0
Motorola	1.3	0.3	0	0	0	0
National	15.3	26.0	33.0	28.1	36.4	8.1
NEC	10.0	18.9	11.3	6.2	3.9	1.6
Ok1	3.4	3.3	2.4	1.8	0	0
SGS	2.7	6.5	7.4	13.9	12.6	45.9
Synertek	0	0	0	0	0	0
Texas Instruments	17.7	22.8	27.7	22.4	18.8	10.7
Thomson	0	0	2.6	6.2	0	0
Toshiba	3.5	1.1	0	0	0	0
WaferScale	0	0	0	0	0	1.9
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

(Continued)

MOS EPROM--Market Share

Table 7 (Continued)

16K EPROM Market Shares (Percentages)

<u>Company</u>	<u>1988</u>
AMD	17.8%
Cypress	13.9
Eurotechnique	0
Fairchild	0
Fujitsu	0
Hitachi	0
Intel	8.7
Matsushita	0
Mitsubishi	0
Mostek	0
Motorola	0
National	7.5
NEC	0.2
Oki	0
SGS	36.7
Synertek	0
Texas Instrument	5.4
Thomson	0
Toshiba	0
WaferScale	<u>9.7</u>
Total	100.0%

Note: Columns may not add to totals
shown because of rounding.

Source: Dataquest
September 1989

MOS EPROM--Market Share

Table 8

32K EPROM Market Shares (Percentages)

<u>Company</u>	<u>1978</u>	<u>1979</u>	<u>1980</u>	<u>1981</u>	<u>1982</u>
AMD	0	3.3%	7.0%	3.3%	7.0%
Eurotechnique	0	0	1.1	0	0
Fujitsu	7.6%	11.8	7.8	11.8	0
Hitachi	13.0	18.7	19.9	18.7	0
Intel	50.8	24.2	21.0	24.2	28.1
Mitsubishi	0	8.5	13.8	8.5	0
Mostek	0.7	0	0	0	0
Motorola	8.8	4.7	1.2	4.7	0
National	0	0.6	1.4	0.6	17.7
NEC	0	6.8	16.4	6.8	16.4
Ricoh	0	0	0	0	0
SGS	0	0	0.2	0	0.2
Texas Instruments	19.2	19.4	6.0	19.4	6.0
Thomson-Eurotechnique	0	0	0	0	0
Toshiba	0	1.9	4.2	1.9	4.2
Others	0	0	0	0	0
Total	100.0%	100.0%	100.0%	100.0%	100.0%

<u>Company</u>	<u>1983</u>	<u>1984</u>	<u>1985</u>	<u>1986</u>	<u>1987</u>
AMD	7.2%	13.3%	20.0%	13.3%	11.3%
Eurotechnique	2.1	0	0	0	0
Fujitsu	9.4	12.0	7.4	1.2	0
Hitachi	20.9	12.3	6.2	3.9	0
Intel	14.5	13.0	16.4	27.8	27.8
Mitsubishi	9.8	5.2	6.8	3.9	0
Mostek	0	0	0	0	0
Motorola	0	0	0	0	0
National	3.5	6.6	6.0	6.0	17.6
NEC	13.4	8.0	6.6	3.5	0.9
Ricoh	0	0.3	1.8	0.5	0
SGS	0.6	3.7	8.7	14.9	15.4
Texas Instruments	15.3	22.6	15.8	19.5	26.5
Thomson-Eurotechnique	0	2.1	4.0	5.6	0
Toshiba	3.2	0.9	0	0	0
Others	0	0.1	0.3	0	0
Total	100.0%	100.0%	100.0%	100.0%	100.0%

(Continued)

MOS EPROM--Market Share

Table 8 (Continued)

32K EPROM Market Shares (Percentages)

<u>Company</u>	<u>1988</u>
AMD	11.4%
Eurotechnique	0
Fujitsu	0
Hitachi	0
ICT	0.3
Intel	33.8
Mitsubishi	0
Mostek	0
Motorola	0
National	13.7
NEC	0.2
Ricoh	0
SGS	18.7
Texas Instrument	21.9
Thomson-Eurotechnique	0
Toshiba	0
Others	<u>0</u>
Total	100.0%

Note: Columns may not add to
totals shown because of rounding.

Source: Dataquest
September 1989

MOS EPROM--Market Share

Table 9

64K EPROM Market Shares (Percentages)

<u>Company</u>	<u>1980</u>	<u>1981</u>	<u>1982</u>	<u>1983</u>	<u>1984</u>	<u>1985</u>	<u>1986</u>	<u>1987</u>
AMD	0	0	4.2%	7.0%	5.9%	6.6%	3.6%	7.4%
Cypress	0	0	0	0	0	0	0	0.4
Fujitsu	7.6%	8.5%	28.0	18.2	14.2	18.1	17.2	15.3
General Instrument	0	0	0	0	0	0	0.2	0
GoldStar	0	0	0	0	0	0	0	0.2
Hitachi	13.0	2.3	9.7	19.8	22.3	21.8	21.9	9.2
Hyundai	0	0	0	0	0	0	0	0.1
Intel	50.8	57.0	41.4	21.5	8.1	11.9	15.6	12.2
Microchip Tech., Inc.	0	0	0	0	0	0	0	1.9
Mitsubishi	0	0	10.6	16.4	21.7	15.3	14.6	8.8
Mostek	0.7	0.7	0	0	0	0	0	0
Motorola	8.8	9.9	2.0	2.3	2.9	1.4	1.1	0.6
National	0	0	0	0	0	0	0.5	7.6
NEC	0	0	1.5	3.0	4.4	7.0	6.5	3.3
Oki	0	0	0	0.6	1.9	1.0	0	2.4
Ricoh	0	0	0	0	0.1	0.8	0.4	0.4
SEEQ	0	0	0.1	1.6	4.0	1.7	1.6	1.1
Seiko-Epson	0	0	0	0	0	0	0.3	0.5
SGS	0	0	0	0	1.2	4.0	6.2	9.6
Sharp	0	0	0	0	0	0	0	0.6
Signetics	0	0	0	0	0	0	0	3.4
Texas Instruments	19.2	21.6	2.2	7.2	10.3	8.1	6.5	6.7
Toshiba	0	0	0.4	2.5	2.9	2.2	3.6	7.8
VLSI Technology	0	0	0	0	0	0.1	0.2	0.5
WaferScale	0	0	0	0	0	0	0	0.2
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

(Continued)

MOS EPROM--Market Share

Table 9 (Continued)

64K EPROM Market Shares (Percentages)

<u>Company</u>	<u>1988</u>
AMD	8.1%
Atmel	0.2
Catalyst	0
Cypress	0.5
Fujitsu	0.7
GoldStar	0.5
Hitachi	0.4
Hyundai	0.6
ICT	0.1
Intel	17.9
Microchip Tech., Inc.	3.6
Mitsubishi	7.6
Motorola	0.0
National	15.2
NEC	1.0
Oki	1.5
Ricoh	0.5
SEEQ	0.8
Seiko-Epson	0.7
SGS-Thomson	17.8
Sharp	0.3
Signetics	9.2
Texas Instruments	8.1
Toshiba	4.3
VLSI Technology	0
WaferScale	<u>0.6</u>
Total	100.0%

Note: Columns may not add to totals
shown because of rounding.

Source: Dataquest
September 1989

MOS EPROM--Market Share

Table 10

128K EPROM Market Shares (Percentages)

<u>Company</u>	<u>1982</u>	<u>1983</u>	<u>1984</u>	<u>1985</u>	<u>1986</u>	<u>1987</u>
AMD	0	15.8%	10.2%	6.9%	7.4%	12.0%
Catalyst	0	0	0	0	0	0
Fujitsu	0	8.6	10.5	11.9	9.3	13.0
General Instrument	0	0	0	0	0.3	0
Hitachi	0	8.6	24.2	22.9	18.5	10.0
Intel	95.6%	60.9	23.4	14.3	20.7	18.0
Matsushita	0	0	0	0.1	0.1	0
Microchip Tech., Inc.	0	0	0	0	0	3.0
Mitsubishi	0	0.5	13.9	17.2	17.3	10.0
National	0	0	0	0	0	2.0
NEC	0	2.0	6.0	15.1	14.3	4.0
Oki	0	0	0	0	0	1.0
SEEQ	0	2.3	5.5	2.1	1.9	1.0
Seiko-Epson	0	0	0	0	1.0	0
SGS-Thomson	0	0	0	0	0	6.0
Texas Instruments	4.4	0	0.3	0.2	1.2	7.0
Toshiba	0	1.2	6.0	9.3	8.9	12.0
VLSI Technology	0	0	0	0	0.1	0
WaferScale	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

(Continued)

MOS EPROM--Market Share

Table 10 (Continued)

128K EPROM Market Shares (Percentages)

<u>Company</u>	<u>1988</u>
AMD	12%
Catalyst	0
Fujitsu	10
Hitachi	0
Intel	19
Microchip Tech., Inc.	8
Mitsubishi	8
National	2
NEC	2
Oki	2
SEEQ	0
Seiko-Epson	0
SGS-Thomson	18
Texas Instrument	12
Toshiba	7
VLSI Technology	0
WaferScale	<u>0</u>
Total	100.0%

Note: Columns may not add to totals
shown because of rounding.

Source: Dataquest
September 1989

MOS EPROM--Market Share

Table 11
256K EPROM Market Shares
(Percentages)

<u>Company</u>	<u>1983</u>	<u>1984</u>	<u>1985</u>	<u>1986</u>	<u>1987</u>
AMD	17.5%	25.9%	14.5%	5.9%	6.1%
Atmel	0	0	0	0	0
Catalyst	0	0	0	0	0
Cypress	0	0	0	0	0
Fujitsu	12.5	9.2	12.3	4.7	8.9
General Instrument	0	0	0.2	6.4	0
Hitachi	0	0	9.3	10.7	10.8
ICT	0	0	0	0	0
Intel	70.0	55.8	37.0	28.2	21.0
Microchip Tech., Inc.	0	0	0	0	5.8
Mitsubishi	0	0.2	1.4	18.0	10.3
National	0	0	0	1.0	5.9
NEC	0	0.2	9.0	13.0	5.7
Oki	0	0	0	0	3.0
Ricoh	0	0	0	0	0
SEEQ	0	0.2	2.6	0.3	0.3
Seiko-Epson	0	0	0	0	0.1
SGS-Thomson	0	0	0	0.2	4.0
Sharp	0	0	0	0	0
Signetics	0	0	0	0	1.1
Texas Instruments	0	0	0.2	1.6	5.0
Toshiba	0	8.5	13.0	9.5	11.7
VLSI Technology	0	0	0	0.3	0.1
WaferScale	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0.1</u>
Total	100.0%	100.0%	100.0%	100.0%	100.0%

(Continued)

MOS EPROM--Market Share

Table 11 (Continued)
256K EPROM Market Shares
(Percentages)

<u>Company</u>	<u>1988</u>
AMD	6.0%
Atmel	0.2
Catalyst	0.1
Cypress	0.2
Fujitsu	10.8
Hitachi	0
ICT	0
Intel	18.6
Microchip Tech., Inc.	9.0
Mitsubishi	8.9
National	11.2
NEC	3.7
Oki	1.4
Ricoh	0.1
SEEQ	0.3
Seiko-Epson	0.2
SGS-Thomson	8.8
Sharp	0.2
Signetics	3.4
Texas Instrument	7.2
Toshiba	9.4
VLSI Technology	0
WaferScale	<u>0.5</u>
Total	100.0%

Note: Columns may not add to totals
shown because of rounding.

Source: Dataquest
September 1989

MOS EPROM--Market Share

Table 12

512K EPROM Market Shares (Percentages)

<u>Company</u>	<u>1984</u>	<u>1985</u>	<u>1986</u>	<u>1987</u>	<u>1988</u>
AMD	50.0%	34.3%	28.6%	9.6%	10.9%
Atmel	0	0	0	0	0.2
Catalyst	0	0	0	0	0.1
Fujitsu	0	2.3	1.7	19.1	11.3
General Instrument	0	0	2.4	0	0
Hitachi	0	3.4	13.3	10.9	11.5
Intel	50.0	60.0	38.8	21.1	14.8
Microchip Tech., Inc.	0	0	0	1.7	3.0
Mitsubishi	0	0	4.2	13.6	10.7
National	0	0	0.3	0	0
NEC	0	0	0	3.4	6.6
Oki	0	0	0	5.8	5.0
SGS-Thomson	0	0	0	1.3	7.4
Texas Instruments	0	0	0	2.8	9.0
Toshiba	0	0	10.3	10.7	9.4
VLSI Technology	0	0	0.1	0.1	0
WaferScale	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0.3</u>
Total	100.0%	100.0%	100.0%	100.0%	100.0%

Note: Columns may not add to totals shown because of rounding.

Source: Dataquest
September 1989

MOS EPROM--Market Share

Table 13

1Mb EPROM Market Shares (Percentages)

<u>Company</u>	<u>1986</u>	<u>1987</u>	<u>1988</u>
AMD	4.1	1.8	5.9%
Atmel	0	0	0.2
Fujitsu	0.3	0.9	15.7
Hitachi	71.4	34.2	12.2
Intel	17.0	18.6	14.1
Microchip Tech., Inc.	0	0	0
Mitsubishi	0	5.4	19.0
National	0	0	0
NEC	0.3	30.0	19.9
Oki	0	0	0
SGS-Thomson	0	0	0.6
Sharp	0	0	0.5
Texas Instrument	0	0	0
Toshiba	<u>6.8</u>	<u>9.0</u>	<u>12.0</u>
Total	100.0%	100.0%	100.0%

Note: Columns may not add to totals shown because of rounding.

Source: Dataquest
September 1989

MOS EPROM--Market Share

Table 14

2Mb EPROM Market Shares (Percentages)

<u>Company</u>	<u>1988</u>
AMD	0
Intel	0
Mitsubishi	0
NEC	<u>S</u>
Total	0

S = Sampling

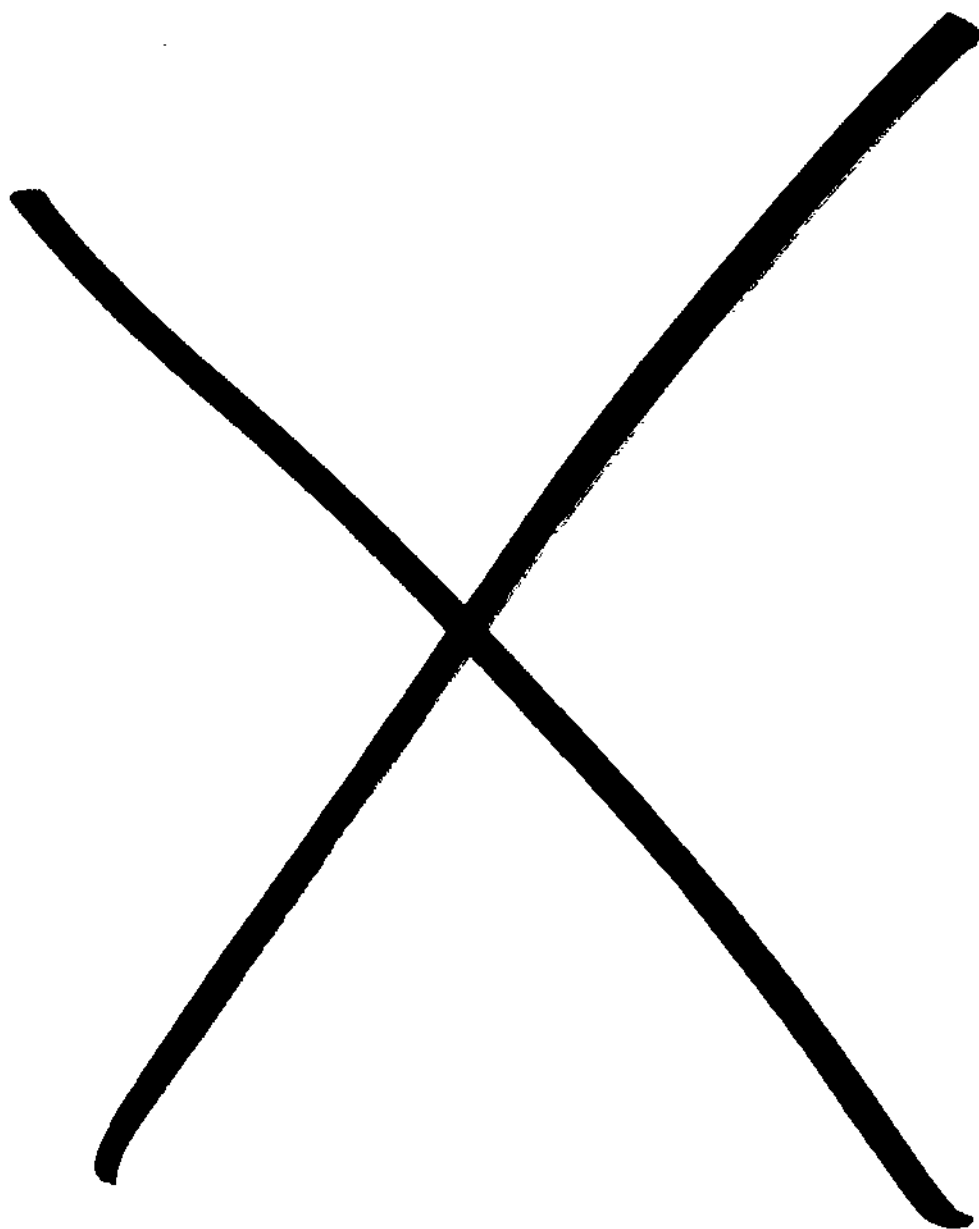
Source: Dataquest
September 1989

Table 15

4Mb EPROM Market Shares (Percentages)

<u>Company</u>	<u>1988</u>
AMD	0
Fujitsu	100.0%
Intel	0
Mitsubishi	0
NEC	0
Toshiba	0
WaferScale	<u>0</u>
Total	100.0%

Source: Dataquest
September 1989



MOS EPROM—Data Update

QUARTERLY COMPANY MOS EPROM SHIPMENT DATA

This section contains unit shipment data on MOS EPROMs for 1988 and 1989. In addition to unit shipments for 16K, 32K, 64K, 128K, 256K, 512K, 1-Mbit, 2-Mbit, and 4-Mbit EPROMs, we have added our estimates of the worldwide billing prices for each product during the four quarters of the year. At the bottom of each table, we show market share data (units, not revenue) for companies based in the United States, Japan, Europe, and Asia/Pacific-Rest of World (ROW). The tables are organized as follows:

- Table 1—16K MOS EPROM Shipment Data, 1988 and 1989
- Table 2—32K MOS EPROM Shipment Data, 1988 and 1989
- Table 3—64K MOS EPROM Shipment Data, 1988 and 1989
- Table 4—128K MOS EPROM Shipment Data, 1988 and 1989
- Table 5—256K MOS EPROM Shipment Data, 1988 and 1989
- Table 6—512K MOS EPROM Shipment Data, 1988 and 1989
- Table 7—1-Mbit MOS EPROM Shipment Data, 1988 and 1989
- Table 8—2-Mbit MOS EPROM Shipment Data, 1988 and 1989
- Table 9—4-Mbit MOS EPROM Shipment Data, 1988 and 1989

Definitions

Prices

Prices are Dataquest estimates of the billing prices during each quarter. These prices are averaged over all package types, lot sizes, and the entire speed mix, and they represent sales to both military and commercial accounts.

Quarterly Revenue

Quarterly revenue is calculated as units shipped times the prevailing price during that period.

Table 1

16K MOS EPROM Shipment Data, 1988 and 1989

Company	MOS Process	1st Qtr.	2nd Qtr.	1988 3rd Qtr.	4th Qtr.	Year
AMD	N	275	345	356	300	1,276
Cypress	C	300	375	325	300	1,300
Intel	N	200	200	175	175	750
National Semi.	C	280	300	320	300	1,200
NEC	N	5	10	0	5	20
SGS-Thomson	N	790	1,040	710	500	3,040
	C	30	35	30	30	125
Texas Instruments	N	85	70	30	25	210
	C	55	50	75	80	260
WaferScale Integ.	C	125	175	255	280	835
	NMOS	1,355	1,665	1,271	1,005	5,296
	CMOS	790	935	1,005	990	3,720
Total		2,145	2,600	2,276	1,995	9,016
Percentage Change from Previous Quarter		(3%)	21%	(12%)	(12%)	
Cumulative Total		269,614	272,214	274,490	276,485	
ASPs:	NMOS	\$2.80	\$3.20	\$3.40	\$3.50	\$3.20
	CMOS	\$6.75	\$5.00	\$4.80	\$4.00	\$5.05
	Overall	\$4.25	\$3.85	\$4.02	\$3.75	\$3.97
Revenue (\$M)		9.1	10.0	9.1	7.5	35.8

1988 Market Share					
	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Year
United States	61.5%	58.3%	67.5%	73.2%	64.7%
Japan	0.2	0.4	0	0.3	0.2
Europe	38.2	41.3	32.5	26.6	35.1
Total	100.0%	100.0%	100.0%	100.0%	100.0%

(Continued)

Table 1 (Continued)

16K MOS EPROM Shipment Data, 1988 and 1989

Company	MOS Process	1989				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N/C	242	224	184	117	767
Cypress	C	400	450	440	410	1,700
Intel	N	150	131	128	111	520
National Semi.	C	300	260	200	160	920
NEC	N	0	0	0	0	0
SGS-Thomson	N	1,000	800	700	650	3,150
	C	60	30	10	0	100
Texas Instruments	N	5	5	5	0	15
	C	75	60	55	45	235
WaferScale Integ.	C	270	250	240	238	998
	NMOS	1,397	1,160	1,017	878	4,452
	CMOS	1,105	1,050	945	853	3,953
Total		2,502	2,210	1,962	1,731	8,405
Percentage Change from Previous Quarter		25%	(12%)	(11%)	(15%)	
Cumulative Total		278,987	281,197	283,159	284,890	
ASPs:	NMOS	\$3.00	\$2.50	\$2.00	\$1.80	\$2.42
	CMOS	\$3.80	\$3.50	\$2.90	\$2.50	\$3.22
	Overall	\$3.35	\$2.98	\$2.43	\$2.14	\$2.79
Revenue (\$M)		8.4	6.6	4.8	3.7	23.5

1989 Market Share

	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Year
United States	57.6%	62.4%	63.8%	62.4%	61.3%
Japan	0	0	0	0	0
Europe	42.4	37.6	36.2	37.6	38.7
Total	100.0%	100.0%	100.0%	100.0%	100.0%

Source: Dataquest
May 1990

Table 2

32K MOS EPROM Shipment Data, 1988 and 1989

Company	MOS Process	1st Qtr.	2nd Qtr.	1988 3rd Qtr.	4th Qtr.	Year
AMD	N	460	540	350	286	1,636
Fujitsu	N	0	0	0	0	0
	C	0	0	0	0	0
Hitachi	N	0	0	0	0	0
ICT	C	6	12	12	16	46
Intel	N	1,250	1,250	1,200	1,000	4,700
	N OTP	0	0	0	0	0
Mitsubishi	N	0	0	0	0	0
National Semi.	C	1,000	1,000	1,000	1,000	4,000
NEC	N	10	20	0	0	30
Ricoh	C	0	0	0	0	0
SGS-Thomson	N	890	630	510	470	2,500
	C	25	15	30	30	100
Texas Instruments	N	850	850	750	600	3,050
	N	3,460	3,290	2,810	2,356	11,916
	C	1,031	1,027	1,042	1,046	4,146
Total		4,491	4,317	3,852	3,402	16,062
Percentage Change from Previous Quarter		23%	(4%)	(11%)	(12%)	
Cumulative Total		266,543	270,860	274,712	278,114	
ASPs:	NMOS	\$3.45	\$3.50	\$3.55	\$3.65	\$3.53
	CMOS	\$3.70	\$3.75	\$3.85	\$4.00	\$3.83
	Overall	\$3.51	\$3.56	\$3.63	\$3.76	\$3.60
Revenue (\$M)		15.8	15.4	14.0	12.8	57.9

		1988 Market Share				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
United States		79.4%	84.6%	86.0%	85.3%	83.6%
Japan		0.2	0.5	0	0	0.2
Europe		20.4	14.9	14.0	14.7	16.2
Total		100.0%	100.0%	100.0%	100.0%	100.0%

(Continued)

Table 2 (Continued)

32K MOS EPROM Shipment Data, 1988 and 1989

Company	MOS Process	1989				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N/C	268	299	196	131	894
Fujitsu	N	0	0	0	0	0
	C	0	0	0	0	0
Hitachi	N	0	0	0	0	0
ICT	C	26	40	70	100	236
Intel	N	1,178	1,150	1,092	980	4,400
	N OTP	0	0	0	0	0
Mitsubishi	N	0	0	0	0	0
National Semi.	C	950	900	940	750	3,540
NEC	N	0	0	0	0	0
Ricoh	C	0	0	0	0	0
SGS-Thomson	N	500	500	670	700	2,370
	C	45	15	5	0	65
Texas Instruments	N	577	568	525	482	2,152
	N	2,523	2,517	2,483	2,293	9,816
	C	1,021	955	1,015	850	3,841
Total		3,544	3,472	3,498	3,143	13,657
Percentage Change from Previous Quarter		4%	(2%)	1%	(10%)	
Cumulative Total		281,658	285,130	288,628	291,771	
ASPs:	NMOS	\$3.50	\$3.00	\$2.80	\$2.50	\$2.98
	CMOS	\$3.70	\$3.00	\$2.60	\$2.30	\$2.92
	Overall	\$3.56	\$3.00	\$2.74	\$2.45	\$2.95
Revenue (\$M)		12.6	10.4	9.6	7.7	40.3

1989 Market Share

	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Year
United States	84.6%	85.2%	80.7%	77.7%	82.2%
Japan	0	0	0	0	0
Europe	15.4	14.8	19.3	22.3	17.8
Total	100.0%	100.0%	100.0%	100.0%	100.0%

Source: Dataquest
May 1990

Table 3

64K MOS EPROM Shipment Data, 1988 and 1989

Company	MOS Process	1st Qtr.	2nd Qtr.	1988 3rd Qtr.	4th Qtr.	Year
AMD	N	1,525	1,340	1,300	1,080	5,245
	C	0	0	0	0	0
Atmel	C	0	0	0	5	5
Cypress	C	100	120	150	250	620
Fujitsu	N	30	27	25	20	102
	C	100	100	70	80	350
Goldstar	C	25	80	100	100	305
	C 35ns	S	2	15	28	45
Hitachi	N	0	0	0	275	275
	C	0	0	0	0	0
	C OTP	0	0	0	0	0
Hyundai	C	800	600	200	0	1,600
ICT	C	11	16	19	23	69
Intel	N	2,100	2,400	2,000	2,300	8,800
	C	250	250	250	580	1,330
	C OTP	150	400	400	600	1,550
Microchip Tech.	C	509	375	554	400	1,838
	C OTP	100	96	150	150	496
Mitsubishi	N	1,200	1,000	1,000	800	4,000
	N OTP	300	300	200	160	960
Motorola	N	0	0	0	0	0
	N OTP	0	0	0	0	0
National Semi.	C	2,850	2,600	2,300	2,200	9,950
NEC	N	0	0	0	0	0
	C	200	100	150	40	490
	C OTP	50	50	50	40	190
Okai	N	100	125	115	120	460
	N OTP	130	130	130	100	490
Ricoh	C	150	100	50	0	300
SEEQ	N	150	150	125	100	525
Seiko-Epson	C	110	125	100	100	435
SGS-Thomson	N	2,045	2,365	2,940	2,600	9,950
	C	330	105	200	250	885
	C OTP	100	100	150	400	750
Sharp	C	45	35	60	60	200
Signetics	C	1,200	1,700	1,900	1,200	6,000

(Continued)

Table 3 (Continued)

64K MOS EPROM Shipment Data, 1988 and 1989

Company	MOS Process	1988				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
Texas Instruments	N	1,300	1,300	1,100	945	4,645
	C	25	50	100	100	275
	C OTP	30	100	110	120	360
Toshiba	N	300	280	260	250	1,090
	N OTP	500	450	400	350	1,700
WaferScale Integ.	C	75	80	100	110	365
	N	9,680	9,867	9,595	9,100	38,242
	C	7,210	7,184	7,178	6,836	28,408
Total		16,890	17,051	16,773	15,936	66,650
Percentage Change from Previous Quarter		(15%)	1%	(2%)	(5%)	
Cumulative Total		476,634	493,685	510,458	526,394	
ASPs:	NMOS	\$3.55	\$3.70	\$3.85	\$4.10	\$3.79
	CMOS	\$3.70	\$3.90	\$4.12	\$4.35	\$4.01
	Overall	\$3.61	\$3.78	\$3.97	\$4.21	\$3.89
Revenue (\$M)		61.0	64.5	66.5	67.0	259.1

	1988 Market Share				Year
	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
United States	54.3%	54.4%	51.6%	56.2%	54.1%
Japan	19.0	16.6	15.6	15.0	16.6
Europe	21.8	25.0	30.9	27.9	26.4
ROW	4.9	4.0	1.9	0.8	2.9
Total	100.0%	100.0%	100.0%	100.0%	100.0%

(Continued)

Table 3 (Continued)

64K MOS EPROM Shipment Data, 1988 and 1989

Company	MOS Process	1989				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	925	634	367	194	2,120
	C 55ns	89	209	705	701	1,704
Atmel	C 45ns	10	10	10	10	40
Cypress	C	200	142	133	125	600
Fujitsu	N	0	0	0	0	0
	C	0	0	0	0	0
Goldstar	C	210	195	190	185	780
	C 35ns	42	65	72	81	260
Hitachi	N	0	0	0	0	0
	C	0	0	0	0	0
	C OTP	0	0	0	0	0
Hyundai	C	0	0	0	0	0
ICT	C	23	30	35	68	156
Intel	N	1,800	1,800	1,800	1,600	7,000
	C	330	330	281	279	1,220
	C OTP	370	352	300	300	1,322
Microchip Tech. Inc.	C	379	262	223	215	1,079
	C OTP	370	174	160	141	845
Mitsubishi	N	300	500	500	500	1,800
	N OTP	100	50	50	10	210
Motorola	N	0	0	0	0	0
	N OTP	0	0	0	0	0
National Semi.	C	3,000	2,550	2,000	2,200	9,750
NEC	N	0	0	0	0	0
	C	75	60	40	0	175
	C OTP	50	50	50	0	150
Oki	N	80	70	60	75	285
	N OTP	190	250	80	140	660
Ricoh	C	0	0	0	0	0
SEEQ	N	138	125	118	100	481
Seiko-Epson	C	100	100	90	90	380
SGS-Thomson	N	2,200	2,300	2,190	2,200	8,890
	C	230	310	290	350	1,180
	N OTP	75	155	300	180	710
	C OTP	420	360	185	120	1,085

(Continued)

Table 3 (Continued)

64K MOS EPROM Shipment Data, 1988 and 1989

Company	MOS Process	1989				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
Sharp	C 55ns	48	40	32	30	150
	C OTP 70ns	45	50	50	50	195
Signetics	C	500	500	500	500	2,000
	C OTP	400	500	700	900	2,500
Texas Instruments	N	900	900	500	400	2,700
	C	240	370	500	780	1,890
	C OTP	135	125	118	112	490
Toshiba	N	200	180	140	100	620
	N OTP	350	300	250	150	1,050
WaferScale Integ.	C	160	190	190	180	720
	N	7,258	7,264	6,355	5,649	26,526
	C	7,426	6,974	6,854	7,417	28,671
Total		14,684	14,238	13,209	13,066	55,197
Percentage Change from Previous Quarter		(8%)	(3%)	(7%)	(1%)	
Cumulative Total		541,078	555,316	568,525	581,591	
ASPs:	NMOS	\$3.70	\$3.10	\$2.80	\$2.60	\$3.09
	CMOS	\$4.00	\$3.10	\$2.80	\$2.50	\$3.10
	Overall	\$3.85	\$3.10	\$2.80	\$2.54	\$3.10
Revenue (\$M)		56.6	44.1	37.0	33.2	170.9

1989 Market Share					
	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Year
United States	61.8%	57.6%	56.3%	56.7%	58.2%
Japan	10.5	11.6	10.2	8.8	10.3
Europe	26.0	29.0	31.5	32.5	29.6
ROW	1.7	1.8	2.0	2.1	1.9
Total	100.0%	100.0%	100.0%	100.0%	100.0%

Source: Dataquest
May 1990

Table 4

128K MOS EPROM Shipment Data, 1988 and 1989

Company	MOS Process	1988				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N 150ns	1,800	2,500	1,700	1,384	7,384
Catalyst	C 55ns	0	0	0	0	0
Fujitsu	N OTP	0	0	10	15	25
	N	900	1,100	875	700	3,575
Hitachi	C	700	870	500	540	2,610
Intel	N	400	400	300	300	1,400
	N	2,200	2,600	2,400	2,600	9,800
	N OTP	100	150	100	100	450
	C	300	200	300	300	1,100
	C OTP	0	50	50	50	150
Microchip Tech. Inc.	C	469	1,113	1,100	1,200	3,882
	C OTP	256	303	321	350	1,230
Mitsubishi	N	1,200	900	900	580	3,580
	C	150	250	150	100	650
	N OTP	200	150	100	100	550
	C OTP	0	0	0	0	0
National Semi.	C	370	360	220	200	1,150
NEC	N	300	600	190	170	1,260
Okii	N	100	100	110	120	430
	N OTP	250	275	240	260	1,025
SEEQ	N	50	25	0	0	75
Seiko-Epson	N	0	0	0	0	0
SGS-Thomson	N	1,980	2,490	3,180	3,300	10,950
Texas Instruments	N	100	100	100	100	400
	C	1,800	2,000	1,800	1,000	6,600
	C OTP	20	70	150	100	340
Toshiba	N	600	550	500	450	2,100
	N OTP	700	650	550	500	2,400
WaferScale Integ.	C	20	20	25	30	95
	N	10,880	12,590	11,255	10,679	45,404
	C	4,085	5,236	4,616	3,870	17,807
Total		14,965	17,826	15,871	14,549	63,211

(Continued)

Table 4 (Continued)

128K MOS EPROM Shipment Data, 1988 and 1989

Company	MOS Process	1st Qtr.	2nd Qtr.	1988 3rd Qtr.	4th Qtr.	Year
Percentage Change from Previous Quarter		1%	19%	(11%)	(8%)	
Cumulative Total		222,361	240,187	256,058	270,607	
ASPs:	NMOS	\$3.85	\$3.90	\$3.95	\$4.10	\$3.95
	CMOS	\$4.40	\$4.45	\$4.50	\$4.55	\$4.47
	Overall	\$4.00	\$4.06	\$4.11	\$4.22	\$4.10
Revenue (\$M)		59.9	72.4	65.2	61.4	258.9
1988 Market Share						
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Year
United States		50.0%	53.2%	52.1%	51.1%	51.7%
Japan		36.8	32.8	27.8	26.3	31.0
Europe		13.2	14.0	20.0	22.7	17.3
Total		100.0%	100.0%	100.0%	100.0%	100.0%

(Continued)

Table 4 (Continued)

128K MOS EPROM Shipment Data, 1988 and 1989

Company	MOS Process	1989				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N 150ns	1,079	946	465	200	2,690
	C 55ns	223	644	1,066	1,867	3,800
Atmel	C 120ns	3	30	47	52	132
Catalyst	N OTP	25	35	40	40	140
Fujitsu	N	800	700	700	600	2,800
	C	520	510	500	400	1,930
Hitachi	N	300	250	250	250	1,050
Intel	N	2,500	2,400	2,100	2,040	9,040
	N OTP	0	0	0	0	0
	C	420	380	350	325	1,475
	C OTP	75	95	90	85	345
Microchip Tech. Inc.	C	531	529	470	423	1,953
	C OTP	350	427	420	425	1,622
Mitsubishi	N	300	350	500	500	1,650
	C	90	100	100	90	380
	N OTP	90	90	90	50	320
	C OTP	0	0	0	0	0
National	C	280	300	270	240	1,090
NEC	N	300	100	60	0	460
Oki	N	40	20	50	50	160
	N OTP	320	130	60	60	570
SEEQ	N	0	0	0	0	0
Seiko-Epson	N	0	0	0	0	0
SGS-Thomson	N	960	1,290	1,620	1,390	5,260
	N OTP	0	40	140	150	330
Texas Instruments	N	210	220	140	120	690
	C	1,800	2,000	2,300	2,300	8,400
	C OTP	200	300	400	400	1,300
Toshiba	N	250	220	160	100	730
	N OTP	150	150	150	100	550
WaferScale Integ.	C	45	55	70	70	240
	N	7,324	6,941	6,525	5,650	26,440
	C	4,537	5,370	6,083	6,677	22,667
Total		11,861	12,311	12,608	12,327	49,107

(Continued)

Table 4 (Continued)

128K MOS EPROM Shipment Data, 1988 and 1989

Company	MOS Process	1st Qtr.	2nd Qtr.	1989 3rd Qtr.	4th Qtr.	Year
Percentage Change from Previous Quarter		(18%)	4%	2%	(2%)	
Cumulative Total		282,468	294,779	307,387	319,714	
ASPs:	NMOS	\$3.85	\$3.40	\$2.90	\$2.60	\$3.24
	CMOS	\$4.10	\$3.50	\$3.00	\$2.60	\$3.22
	Overall	\$3.93	\$3.44	\$2.94	\$2.60	\$3.23
Revenue (\$M)		46.8	42.4	37.2	32.1	158.4
1989 Market Share						
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Year
United States		65.3%	67.9%	65.3%	69.7%	67.0%
Japan		26.6	21.3	20.8	17.8	21.6
Europe		8.1	10.8	14.0	12.5	11.4
Total		100.0%	100.0%	100.0%	100.0%	100.0%

Source: Dataquest
May 1990

Table 5
256K MOS EPROM Shipment Data, 1988 and 1989

Company	MOS Process	1st Qtr.	2nd Qtr.	1988 3rd Qtr.	4th Qtr.	Year
AMD	N	1,585	1,535	1,400	970	5,490
	C	250	300	720	1,127	2,397
Atmel	C	45	51	50	54	200
Catalyst	N OTP	0	0	25	50	75
Cypress	C	0	0	0	0	0
Fujitsu	N	1,000	1,100	1,000	1,000	4,100
	C	2,600	2,400	2,500	2,500	10,000
Hitachi	N	0	0	0	0	0
	C	900	1,100	1,200	1,100	4,300
	C OTP	300	400	500	300	1,500
Intel	N	4,500	4,900	4,600	4,800	18,800
	C	300	400	450	1,200	2,350
	N OTP	550	650	400	550	2,150
	C OTP	150	350	250	300	1,050
Microchip Tech. Inc.	N	1,500	1,800	800	300	4,400
	C	300	700	1,500	2,900	5,400
	C OTP	200	400	600	750	1,950
Mitsubishi	N	1,200	1,200	1,200	800	4,400
	C	1,000	1,300	1,200	1,000	4,500
	N OTP	200	350	200	50	800
	C OTP	200	450	600	700	1,950
National Semi.	C	3,615	3,900	3,800	3,312	14,627
NEC	N	250	300	150	0	700
	C	900	1,200	1,000	1,000	4,100
Oki	N	120	105	110	80	415
	N OTP	430	360	300	320	1,410
Ricoh	C	25	30	35	40	130
SEEQ	C	120	80	70	70	340
Seiko-Epson	C	30	55	70	70	225
SGS-Thomson	N	2,010	2,045	2,765	3,350	10,170
	C	0	20	315	520	855
	C OTP	0	0	50	400	450
Signetics	C	1,080	1,100	1,300	1,020	4,500
Sharp	C	50	50	80	80	260
Texas Instruments	C	2,200	2,200	2,300	2,100	8,800
	C OTP	50	100	200	300	650

(Continued)

Table 5 (Continued)

256K MOS EPROM Shipment Data, 1988 and 1989

Company	MOS Process	1988				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
Toshiba	N	900	750	660	500	2,810
	C	1,200	1,150	1,050	1,000	4,400
	N OTP	600	500	450	350	1,900
	C OTP	900	800	750	700	3,150
WaferScale Integ.	C	100	125	180	200	605
	N	14,845	15,595	14,060	13,120	57,620
	C	16,515	18,661	20,770	22,743	78,689
Total		31,360	34,256	34,830	35,863	136,309
Percentage Change from Previous Quarter		6%	9%	2%	3%	
Cumulative Total		244,353	278,609	313,439	349,302	
ASPs:	NMOS	\$4.50	\$4.50	\$4.50	\$4.60	\$4.52
	CMOS	\$5.20	\$5.10	\$5.10	\$5.05	\$5.11
	Overall	\$4.87	\$4.83	\$4.86	\$4.89	\$4.86
Revenue (\$M)		152.7	165.3	169.2	175.2	662.4

	1988 Market Share				Year
	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
United States	49.3%	51.1%	49.8%	52.9%	50.8%
Japan	40.8	39.7	37.5	32.3	37.5
Europe	9.9	9.2	12.7	14.8	11.7
Total	100.0%	100.0%	100.0%	100.0%	100.0%

(Continued)

Table 5 (Continued)

256K MOS EPROM Shipment Data, 1988 and 1989

Company	MOS Process	1989				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N 170ns	858	746	365	144	2,113
	C 55ns	1,231	1,795	3,247	4,726	10,999
Atmel	C 55ns	950	800	590	645	2,985
Catalyst	N OTP	50	48	52	55	205
Cypress	C	1	4	7	8	20
Fujitsu	N	1,100	1,100	1,100	1,100	4,400
	C	3,200	3,200	3,200	3,200	12,800
Hitachi	N	0	0	0	0	0
	C	900	800	800	800	3,300
	C OTP	300	300	300	300	1,200
Intel	N	4,400	4,300	4,100	3,900	16,700
	C	980	1,000	1,000	1,000	3,980
	N OTP	500	550	400	350	1,800
	C OTP	300	250	300	250	1,100
Microchip Tech. Inc.	N	500	431	422	391	1,744
	C	1,662	1,421	1,789	2,079	6,951
	C OTP	850	815	1,225	1,625	4,515
Mitsubishi	N	400	350	350	200	1,300
	C	1,100	1,000	1,000	1,000	4,100
	N OTP	50	30	20	20	120
	C OTP	700	700	1,000	1,200	3,600
National Semi.	C	3,300	3,200	3,041	4,100	13,641
NEC	N	100	100	50	0	250
	C	800	900	900	900	3,500
	C OTP	0	0	0	0	0
Oki	N	40	30	30	20	120
	N OTP	270	170	160	100	700
Ricoh	C	0	0	0	0	0
SEEQ	C	90	80	70	60	300
Seiko-Epson	C	0	140	130	130	400
SGS-Thomson	N	2,000	2,450	2,900	2,600	9,950
	C	350	550	600	900	2,400
	N OTP	0	50	150	450	650
	C OTP	100	200	350	350	1,000
Signetics	C	1,220	1,420	1,700	2,100	6,440
	C OTP	400	900	1,300	1,800	4,400

(Continued)

Table 5 (Continued)

256K MOS EPROM Shipment Data, 1988 and 1989

Company	MOS Process	1989				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
Sharp	C	50	50	80	80	260
	C OTP 90ns	50	50	50	50	200
Texas Instruments	C	3,400	4,000	4,000	4,000	15,400
	C OTP	50	100	200	300	650
Toshiba	N	400	300	250	250	1,200
	C	500	400	400	300	1,600
	N OTP	400	300	200	150	1,050
	C OTP	600	600	600	800	2,600
WaferScale Integ.	C	100	125	180	220	625
	N	11,068	10,955	10,549	9,730	42,302
	C	23,184	24,800	28,059	32,923	108,966
Total		34,252	35,755	38,608	42,653	151,268
Percentage Change from Previous Quarter		(4%)	4%	8%	10%	
Cumulative Total		383,554	419,309	457,917	500,570	
ASPs:	NMOS	\$4.20	\$3.50	\$3.00	\$2.70	\$3.40
	CMOS	\$4.50	\$3.70	\$3.10	\$2.70	\$3.42
	Overall	\$4.40	\$3.64	\$3.07	\$2.70	\$3.40
Revenue (\$M)		150.8	130.1	118.6	115.2	514.7

1989 Market Share					
	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Year
United States	56.1%	55.0%	54.4%	55.9%	55.4%
Japan	32.0	29.4	27.5	24.9	28.2
Europe	11.9	15.6	18.1	19.2	16.4
Total	100.0%	100.0%	100.0%	100.0%	100.0%

Source: Dataquest
May 1990

Table 6

512K MOS EPROM Shipment Data, 1988 and 1989

Company	MOS Process	1988				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	550	1,000	1,100	1,083	3,733
	C 70ns	495	600	900	1,066	3,061
Atmel	C	32	76	150	260	518
Catalyst	N OTP	0	0	20	30	50
Fujitsu	C	1,700	1,800	2,000	2,100	7,600
Hitachi	N	200	250	250	250	950
	C	200	250	250	250	950
Intel	N	2,700	2,500	1,900	1,900	9,000
Microchip Tech. Inc.	C	120	100	200	900	1,320
	C OTP	40	50	100	300	490
Mitsubishi	N	2,000	1,700	1,200	1,100	6,000
	C	NA	NA	50	500	550
National Semi.	C	0	0	0	0	0
NEC	C	1,100	1,100	1,000	800	4,000
Oki	N	180	110	100	90	480
	N OTP	670	610	600	660	2,540
SGS-Thomson	N	605	1,055	1,125	1,700	4,485
Texas Instruments	C	900	1,200	1,500	1,400	5,000
	C OTP	50	100	170	150	470
Toshiba	N	800	750	700	600	2,850
	N OTP	700	600	550	450	2,300
WaferScale Integ.	C	0	30	120	300	450
	C OTP	0	0	40	60	100
	C	S	50	55	70	175
	N	8,405	8,575	7,545	7,863	32,388
	C	4,637	5,356	6,535	8,156	24,684
Total		13,042	13,931	14,080	16,019	57,072
Percentage Change from Previous Quarter		9%	7%	1%	14%	
Cumulative Total		49,855	63,786	77,866	93,885	
ASPs:	NMOS	\$7.20	\$7.00	\$7.10	\$7.20	\$7.12
	CMOS	\$8.00	\$7.80	\$7.75	\$7.70	\$7.79
	Overall	\$7.48	\$7.31	\$7.40	\$7.45	\$7.41
Revenue (\$M)		97.6	101.8	104.2	119.4	423.0

(Continued)

Table 6 (Continued)

512K MOS EPROM Shipment Data, 1988 and 1989

	1988 Market Share				Year
	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
United States	37.5%	40.7%	43.3%	44.7%	41.7%
Japan	57.9	51.7	48.7	44.7	50.4
Europe	4.6	7.6	8.0	10.6	7.9
Total	100.0%	100.0%	100.0%	100.0%	100.0%

Company	MOS Process	1989				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	303	83	25	19	430
	C 70ns	2,270	2,324	3,173	3,677	11,444
Atmel	C	619	477	188	512	1,796
Catalyst	N OTP	44	48	65	55	212
Fujitsu	C	2,100	2,200	2,200	2,200	8,700
Hitachi	N	150	120	70	70	410
	C	150	130	80	80	440
Intel	N	2,800	3,000	3,000	2,900	11,700
Microchip Tech. Inc.	C	351	390	374	462	1,577
	C OTP	170	225	220	250	865
Mitsubishi	N	850	750	700	700	3,000
	C 100ns	500	500	350	350	1,700
National Semi.	C	600	830	1,120	1,460	4,010
NEC	C	800	900	1,100	700	3,500
Oki	N	60	30	50	40	180
	N OTP	600	620	300	250	1,770
SGS-Thomson	N	2,300	2,500	2,600	2,600	10,000
	C	0	0	0	400	400
Signetics	C	S	75	325	600	1,000
	C OTP	S	50	150	300	500
Texas Instruments	C	2,400	3,400	3,600	3,700	13,100
	C OTP	200	255	400	400	1,255

(Continued)

Table 6 (Continued)

512K MOS EPROM Shipment Data, 1988 and 1989

Company	MOS Process	1989				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
Toshiba	N	450	350	250	150	1,200
	N OTP	500	400	300	100	1,300
	C	200	180	160	140	680
	C OTP	100	100	100	100	400
WaferScale Integ.	C	85	110	130	150	475
	N	8,057	7,901	7,360	6,884	30,202
	C	10,545	12,146	13,670	15,481	51,842
Total		18,602	20,047	21,030	22,365	82,044
Percentage Change from Previous Quarter		16%	8%	5%	6%	
Cumulative Total		112,487	132,534	153,564	175,929	
ASPs:	NMOS	\$6.10	\$5.40	\$4.70	\$3.80	\$5.05
	CMOS	\$6.60	\$5.80	\$5.10	\$4.40	\$5.36
	Overall	\$6.38	\$5.64	\$4.96	\$4.22	\$5.25
Revenue (\$M)		118.7	113.1	104.3	94.3	430.4

1989 Market Share

	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Year
United States	52.9%	55.6%	58.5%	60.7%	57.1%
Japan	34.7	31.3	26.9	21.8	28.4
Europe	12.4	13.1	14.6	17.4	14.5
Total	100.0%	100.0%	100.0%	100.0%	100.0%

NA = Not available
S = Sampling

Source: Dataquest
May 1990

Table 7

1-Mbit MOS EPROM Shipment Data, 1988 and 1989

Company	Technology	Max. Acc.T.	Features	1988				Year
				1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	CMOS	150ns	x8	0	5	105	337	447
	CMOS	150ns	x16	30	50	50	79	209
Atmel	CMOS	70ns	x16	S	0	0	0	0
Fujitsu	CMOS		x8, x16	180	360	550	620	1,710
Hitachi	CMOS	110ns	x8	500	500	600	650	2,250
			x16	100	100	100	150	450
Intel	NMOS		x8, x16	180	190	250	650	1,270
Mitsubishi	CMOS	120ns	x8, x16	100	300	450	750	1,600
	CMOS/OTP		x8, x16	NA	S	40	80	120
NEC	CMOS		x8	280	160	370	420	1,230
	CMOS		x16	100	80	240	150	570
Okidata	CMOS		x8, x16	0	0	0	0	0
SGS-Thomson	CMOS		x16	NA	NA	S	50	50
Sharp	CMOS		x8, x16	0	5	10	30	45
Toshiba	CMOS		x8	150	175	200	350	875
	CMOS	150ns	x16	NA	S	5	10	15
	CMOS/OTP		x8	NA	S	0	5	5
	CMOS/OTP		x16	20	20	50	100	190
	N			180	190	250	650	1,270
	C			1,360	1,655	2,670	3,631	9,316
Total				1,540	1,845	2,920	4,281	10,586
Percentage Change from Previous Quarter				61%	20%	58%	47%	
Cumulative Total				1,540	3,385	6,305	10,586	
ASPs:	NMOS			\$25.00	\$23.00	\$22.00	\$21.00	\$22.06
	CMOS			\$21.00	\$20.00	\$19.00	\$18.00	\$19.08
	Overall			\$21.47	\$20.31	\$19.26	\$18.46	\$19.44
Revenue (\$M)				33.1	37.5	56.2	79.0	205.8

(Continued)

Table 7 (Continued)

1-Mbit MOS EPROM Shipment Data, 1988 and 1989

	1988 Market Share				Year
	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
United States	13.6%	13.3%	13.9%	24.9%	18.2%
Japan	86.4	86.7	86.1	73.9	81.3
Europe	0	0	0	1.2	0.5
Total	100.0%	100.0%	100.0%	100.0%	100.0%

Company	Technology	Max. Acc.T.	Features	1989				Year
				1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	CMOS	100ns	x8	786	1,365	1,239	1,854	5,244
	CMOS	90ns	x16	79	325	387	657	1,448
Atmel	CMOS	70ns	x8, x16	2	13	41	46	102
Catalyst	CMOS		x8	0	2	5	8	15
			x16	0	0	1	6	7
Fujitsu	CMOS		x8, x16	800	1,100	1,400	1,400	4,700
Hitachi	CMOS	110ns	x8	700	800	800	800	3,100
			x16	200	200	200	200	800
ICT	CMOS	55ns	x8	NA	NA	S	2	2
Intel	CMOS		x8, x16	790	900	1,000	1,110	3,800
Mitsubishi	CMOS	120ns	x8, x16	1,500	1,200	500	700	3,900
	CMOS/OTP		x8, x16	120	300	300	200	920
National	CMOS	200ns	x8	0	0	10	20	30
NEC	CMOS		x8	600	800	600	500	2,500
			x16	250	250	250	250	1,000
Okii	CMOS		x8, x16	0	50	0	0	50
SGS-Thomson	CMOS		x8, x16	90	210	300	390	900
Sharp	CMOS		x8, x16	85	180	200	255	720
Signetics	CMOS	200ns	x16	S	0	5	20	25
Texas Instruments	CMOS	150ns	x16	0	10	55	200	265

(Continued)

Table 7 (Continued)

1-Mbit MOS EPROM Shipment Data, 1988 and 1989

Company	Technology	Max. Acc.T.	Features	1989				Year
				1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
Toshiba	CMOS	150ns	x8	600	800	900	700	3,000
	CMOS		x16	30	50	70	60	210
	CMOS/OTP		x8	200	300	350	600	1,450
	CMOS/OTP		x16	0	0	10	20	30
WaferScale	CMOS		x8	NA	NA	S	0	0
Total				6,832	8,855	8,623	9,998	34,308
Percentage Change from Previous Quarter				60%	30%	(3%)	16%	
Cumulative Total				17,418	26,273	34,896	44,894	
ASPs	CMOS			\$17.00	\$14.00	\$11.00	\$8.00	\$12.09
Revenue (\$M)				116.1	124.0	94.9	80.0	415.0

	1989 Market Share				Year
	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
United States	24.3%	29.5%	31.8%	39.0%	31.8%
Japan	74.4	68.1	64.7	56.9	65.2
Europe	1.3	2.4	3.5	4.1	3.0
Total	100.0%	100.0%	100.0%	100.0%	100.0%

NA = Not available
S = Sampling

Source: Dataquest
May 1990

Table 8

2-Mbit MOS EPROM Shipment Data, 1988 and 1989

Company	MOS Process	Technology Features	1st Qtr.	2nd Qtr.	1988		Year
					3rd Qtr.	4th Qtr.	
NEC	CMOS	x8 150ns	NA	NA	S	40	40
Total			0	0	0	40	40
Percentage Change from Previous Quarter			0	0	0	0	
Cumulative Total			0	0	0	40	
ASPs:	CMOS						0
Revenue (\$M)			0	0	0	0	0

	1988 Market Share				Year
	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
United States	0	0	0	0	0
Japan	0	0	0	0	0
Europe	0	0	0	0	0
Total	0	0	0	0	0

(Continued)

Table 8 (Continued)

2-Mbit MOS EPROM Shipment Data, 1988 and 1989

Company	MOS Process	Technology Features	1st Qtr.	2nd Qtr.	1989		Year
					3rd Qtr.	4th Qtr.	
AMD	CMOS	100ns		S	0	8	8
Intel	CMOS	x8 150ns	NA	S	5	10	15
	CMOS	x16 150ns	NA	S	0	5	5
Mitsubishi	CMOS	x8 100ns	S	0	1	10	11
	CMOS	x16 100ns	S	0	2	5	7
NEC	CMOS	x8 150ns	100	100	200	300	700
Total			100	100	208	338	746
Percentage Change from Previous Quarter							
Cumulative Total			100	200	408	746	
ASPs:			\$55.00	\$40.00	\$35.00	\$25.00	\$33.82
Revenue (\$M)			5.5	4.0	7.3	8.5	25.2

	1989 Market Share				Year
	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
United States	0	0	2.4%	6.8%	3.8%
Japan	100.0%	100.0%	97.6	93.2	96.2
Europe	0	0	0	0	0
Asia/Pacific	0	0	0	0	0
Total	100.0%	100.0%	100.0%	100.0%	100.0%

NA = Not available
S = Sampling

Source: Dataquest
May 1990

Table 9

4-Mbit MOS EPROM Shipment Data, 1988 and 1989

Company	MOS Process	Technology Features	1st Qtr.	2nd Qtr.	1988		Year
					3rd Qtr.	4th Qtr.	
Fujitsu	CMOS	x8	NA	NA	NA	NA	0
Intel	CMOS	x16 90ns	NA	NA	NA	NA	0
NEC	CMOS	x8 150ns	NA	NA	NA	S	0
Toshiba	CMOS	x8 120ns	NA	NA	NA	S	0
Total			0	0	0	0	0
Percentage Change from Previous Quarter				0	0	0	
Cumulative Total			0	0	0	0	
ASPs:			0	0	0	0	0
Revenue (\$M)			0	0	0	0	0

	1988 Market Share				Year
	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
United States	0	0	0	0	0
Japan	0	0	0	0	0
Europe	0	0	0	0	0
Total	0	0	0	0	0

(Continued)

Table 9 (Continued)

4-Mbit MOS EPROM Shipment Data, 1988 and 1989

Company	MOS Process	Technology Features	1st Qtr.	2nd Qtr.	1989 3rd Qtr.	4th Qtr.	Year
AMD	CMOS		NA	NA	NA	NA	0
Fujitsu	CMOS	x8 150ns	NA	NA	NA	S	0
	CMOS	x16 150ns	NA	NA	NA	S	0
Hitachi	CMOS	x16 150ns	NA	S	0	10	10
Intel	CMOS	x16 150ns	NA	S	5	15	20
Mitsubishi	CMOS	x16 120ns	NA	NA	S	1	1
NEC	CMOS	x8 150ns	S	4	12	22	38
Toshiba	CMOS	x8 150ns	0	0	10	20	30
Total			0	4	27	68	99
Percentage Change from Previous Quarter							
Cumulative Total			0	4	31	99	
ASPs:	Overall		\$100.00	\$80.00	\$64.00	\$50.00	\$55.03
Revenue (\$M)			0	0.3	1.7	3.4	5.4

	1989 Market Share				Year
	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
United States	0	0	18.5%	22.1%	20.2%
Japan	0	100.0%	81.5	77.9	79.8
Europe	0	0	0	0	0
Total	0	100.0%	100.0%	100.0%	100.0%

NA = Not available
S = Sampling

Source: Dataquest
May 1990

MOS EPROM--Data

QUARTERLY COMPANY MOS EPROM SHIPMENT DATA

This section contains historical unit shipment data on MOS EPROMs from 1976 through 1987. In addition to unit shipments for 8K, 16K, 32K, 64K, 128K, 256K, 512K, and 1-Mbit EPROMs, we have added our estimates of the worldwide billing prices for each product during the four quarters of the year. At the bottom of each table, we show market share data (units, not revenue) for companies based in the United States, Japan, Europe, and Asia Pacific. The tables are organized as follows:

- Table 1--8K MOS EPROM Shipment Data, 1976-1985
- Table 2--16K MOS EPROM Shipment Data, 1976-1987
- Table 3--32K MOS EPROM Shipment Data, 1978-1987
- Table 4--64K MOS EPROM Shipment Data, 1980-1987
- Table 5--128K MOS EPROM Shipment Data, 1982-1987
- Table 6--256K MOS EPROM Shipment Data, 1983-1987
- Table 7--512K MOS EPROM Shipment Data, 1984-1987
- Table 8--1-Mbit MOS EPROM Shipment Data, 1986-1987

Definitions

Prices

Prices are Dataquest estimates of the billing prices during each quarter. These prices are averaged over all package types, lot sizes, and the entire speed mix, and they represent sales to both military and commercial accounts.

Quarterly Revenue

Quarterly revenue is calculated as units shipped times the prevailing price during that period.

MOS EPROM--Data

Table 1
8K MOS EPROM Shipment Data, 1976-1985

<u>Company</u>	<u>1976</u>				<u>Year</u>
	<u>1st</u> <u>Qtr.</u>	<u>2nd</u> <u>Qtr.</u>	<u>3rd</u> <u>Qtr.</u>	<u>4th</u> <u>Qtr.</u>	
AMD					
Electronic Arrays	N/A	N/A	N/A	S	S
Fairchild	N/A	N/A	N/A	N/A	N/A
Fujitsu	N/A	N/A	N/A	S	S
Intel	S	25	75	125	225
Mitsubishi	N/A	N/A	N/A	N/A	N/A
Motorola	N/A	N/A	N/A	N/A	N/A
National Semi.	N/A	N/A	N/A	N/A	N/A
Oki Electric	N/A	N/A	N/A	N/A	N/A
Texas Instruments	N/A	N/A	S	5	5
Toshiba	<u>N/A</u>	<u>S</u>	<u>20</u>	<u>50</u>	<u>70</u>
Total	S	25	95	180	300
Percentage Change from Previous Quarter	0	0	280%	89%	
Cumulative Total	0	25	120	300	
Average Selling Price	\$80.00	\$50.00	\$35.00	\$30.00	\$33.25
Revenue (\$M)	0	1.3	3.3	5.4	10.0

	<u>1976</u>				<u>Year</u>
	<u>1st</u> <u>Qtr.</u>	<u>2nd</u> <u>Qtr.</u>	<u>3rd</u> <u>Qtr.</u>	<u>4th</u> <u>Qtr.</u>	
Market Share					
U.S.	0	100.0%	78.9%	72.2%	76.7%
Japan	0	0	21.1	27.8	23.3
Europe	0	0	0	0	0
Total	0	100.0%	100.0%	100.0%	100.0%

N/A = Not Available
S = Sampling

(Continued)

MOS EPROM--Data

Table 1 (Continued)
8K MOS EPROM Shipment Data, 1976-1985

<u>Company</u>	<u>1977</u>				<u>Year</u>
	<u>1st</u> <u>Qtr.</u>	<u>2nd</u> <u>Qtr.</u>	<u>3rd</u> <u>Qtr.</u>	<u>4th</u> <u>Qtr.</u>	
AMD					
Electronic Arrays	10	15	50	75	150
Fairchild	0	0	0	5	5
Fujitsu	10	15	25	40	90
Intel	200	325	475	600	1,600
Mitsubishi	N/A	N/A	N/A	N/A	N/A
Motorola	S	15	20	35	70
National Semi.	S	25	40	85	150
Oki Electric	N/A	N/A	N/A	N/A	N/A
Texas Instruments	15	25	40	70	150
Toshiba	<u>100</u>	<u>100</u>	<u>200</u>	<u>300</u>	<u>700</u>
Total	335	520	850	1,210	2,915
Percentage Change from Previous Quarter	86%	55%	63%	42%	
Cumulative Total	635	1,155	2,005	3,215	
Average Selling Price	\$30.00	\$25.00	\$21.00	\$18.00	\$21.50
Revenue (\$M)	10.1	13.0	17.9	21.8	62.7

	<u>1977</u>				<u>Year</u>
	<u>1st</u> <u>Qtr.</u>	<u>2nd</u> <u>Qtr.</u>	<u>3rd</u> <u>Qtr.</u>	<u>4th</u> <u>Qtr.</u>	
Market Share					
U.S.	67.2%	77.9%	73.5%	71.9%	72.9%
Japan	32.8	22.1	26.5	28.1	27.1
Europe	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total	100.0%	100.0%	100.0%	100.0%	100.0%

N/A = Not Available
S = Sampling

(Continued)

MOS EPROM---Data

Table 1 (Continued)
8K MOS EPROM Shipment Data, 1976-1985

<u>Company</u>	<u>1978</u>				<u>Year</u>
	<u>1st</u> <u>Qtr.</u>	<u>2nd</u> <u>Qtr.</u>	<u>3rd</u> <u>Qtr.</u>	<u>4th</u> <u>Qtr.</u>	
AMD	15	50	80	340	485
Electronic Arrays	30	50	60	60	200
Fairchild	40	60	60	120	280
Fujitsu	50	90	70	70	280
Intel	700	900	800	1,000	3,400
Mitsubishi	50	125	175	250	600
Motorola	100	250	250	420	1,020
National Semi.	275	260	310	405	1,250
Oki Electric	N/A	N/A	N/A	N/A	N/A
Texas Instruments	350	550	400	800	2,100
Toshiba	<u>N/A</u>	<u>N/A</u>	<u>10</u>	<u>30</u>	<u>40</u>
Total	1,610	2,335	2,215	3,495	9,655
Percentage Change from Previous Quarter	33%	45%	(5%)	58%	
Cumulative Total	4,825	7,160	9,375	12,870	
Average Selling Price	\$15.00	\$9.00	\$5.00	\$4.50	\$7.45
Revenue (\$M)	24.2	21.0	11.1	15.7	72.0

	<u>1978</u>				<u>Year</u>
	<u>1st</u> <u>Qtr.</u>	<u>2nd</u> <u>Qtr.</u>	<u>3rd</u> <u>Qtr.</u>	<u>4th</u> <u>Qtr.</u>	
Market Share					
U.S.	93.8%	90.8%	88.5%	90.0%	90.5%
Japan	6.2	9.2	11.5	10.0	9.5
Europe	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total	100.0%	100.0%	100.0%	100.0%	100.0%

N/A = Not Available

(Continued)

MOS EPROM--Data

Table 1 (Continued)
8K MOS EPROM Shipment Data, 1976-1985

<u>Company</u>	<u>1979</u>				<u>Year</u>
	<u>1st</u> <u>Qtr.</u>	<u>2nd</u> <u>Qtr.</u>	<u>3rd</u> <u>Qtr.</u>	<u>4th</u> <u>Qtr.</u>	
AMD	600	700	700	500	2,500
Electronic Arrays	75	100	125	35	335
Fairchild	160	200	350	600	1,310
Fujitsu	70	50	50	50	220
Intel	1,100	1,400	1,400	1,100	5,000
Mitsubishi	190	240	240	270	940
Motorola	700	750	1,000	1,000	3,450
National Semi.	600	800	800	900	3,100
Ok Electric	N/A	N/A	N/A	N/A	N/A
Texas Instruments	800	800	800	800	3,200
Toshiba	<u>50</u>	<u>100</u>	<u>100</u>	<u>50</u>	<u>300</u>
Total	4,345	5,140	5,565	5,305	20,355
Percentage Change from Previous Quarter	24%	18%	8%	(5%)	
Cumulative Total	17,215	22,355	27,920	33,225	
Average Selling Price	\$6.00	\$8.00	\$7.00	\$5.50	\$6.65
Revenue (\$M)	26.1	41.1	39.0	29.2	135.3
	<u>1979</u>				<u>Year</u>
	<u>1st</u> <u>Qtr.</u>	<u>2nd</u> <u>Qtr.</u>	<u>3rd</u> <u>Qtr.</u>	<u>4th</u> <u>Qtr.</u>	
Market Share					
U.S.	92.9%	92.4%	93.0%	93.0%	92.8%
Japan	7.1	7.6	7.0	7.0	7.2
Europe	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total	100.0%	100.0%	100.0%	100.0%	100.0%

N/A = Not Available

(Continued)

MOS EPROM--Data

Table 1 (Continued)

8K MOS EPROM Shipment Data, 1976-1985

<u>Company</u>	<u>1980</u>				<u>Year</u>
	<u>1st</u> <u>Qtr.</u>	<u>2nd</u> <u>Qtr.</u>	<u>3rd</u> <u>Qtr.</u>	<u>4th</u> <u>Qtr.</u>	
AMD	600	700	650	350	2,300
Electronic Arrays	0	0	0	0	0
Fairchild	750	1,000	850	600	3,200
Fujitsu	50	50	50	50	200
Intel	700	500	500	250	1,950
Mitsubishi	160	60	90	80	390
Motorola	500	500	350	250	1,600
National Semi.	1,000	1,000	700	600	3,300
Oki Electric	N/A	N/A	N/A	S	N/A
Texas Instruments	800	600	600	580	2,580
Toshiba	<u>35</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>35</u>
Total	4,595	4,410	3,790	2,760	15,555
Percentage Change from Previous Quarter	(13%)	(4%)	(14%)	(27%)	
Cumulative Total	37,820	42,230	46,020	48,780	
Average Selling Price	\$5.00	\$4.50	\$4.50	\$3.00	\$4.38
Revenue (\$M)	23.0	19.8	17.1	8.3	68.2
	<u>1980</u>				<u>Year</u>
	<u>1st</u> <u>Qtr.</u>	<u>2nd</u> <u>Qtr.</u>	<u>3rd</u> <u>Qtr.</u>	<u>4th</u> <u>Qtr.</u>	
Market Share					
U.S.	94.7%	97.5%	96.3%	95.3%	96.0%
Japan	5.3	2.5	3.7	4.7	4.0
Europe	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total	100.0%	100.0%	100.0%	100.0%	100.0%

N/A = Not Available

S = Sampling

(Continued)

MOS EPROM--Data

Table 1 (Continued)
8K MOS EPROM Shipment Data, 1976-1985

<u>Company</u>	<u>1981</u>				<u>Year</u>
	<u>1st</u> <u>Qtr.</u>	<u>2nd</u> <u>Qtr.</u>	<u>3rd</u> <u>Qtr.</u>	<u>4th</u> <u>Qtr.</u>	
AMD	500	200	200	190	1,090
Electronic Arrays	0	0	0	0	0
Fairchild	300	240	150	50	740
Fujitsu	50	20	10	0	80
Intel	200	150	100	50	500
Mitsubishi	110	40	30	25	205
Motorola	150	175	150	220	695
National Semi.	400	350	200	100	1,050
Oki Electric	50	50	70	50	220
Texas Instruments	550	400	300	200	1,450
Toshiba	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total	2,310	1,625	1,210	885	6,030
Percentage Change from Previous Quarter	(16%)	(30%)	(26%)	(27%)	
Cumulative Total	51,090	52,715	53,925	54,810	
Average Selling Price	\$3.50	\$3.00	\$2.50	\$2.00	\$2.94
Revenue (\$M)	8.1	4.9	3.0	1.8	17.8
	<u>1981</u>				<u>Year</u>
	<u>1st</u> <u>Qtr.</u>	<u>2nd</u> <u>Qtr.</u>	<u>3rd</u> <u>Qtr.</u>	<u>4th</u> <u>Qtr.</u>	
Market Share					
U.S.	90.9%	93.2%	90.9%	91.5%	91.6%
Japan	9.1	6.8	9.1	8.5	8.4
Europe	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total	100.0%	100.0%	100.0%	100.0%	100.0%

(Continued)

MOS EPROM--Data

Table 1 (Continued)
8K MOS EPROM Shipment Data, 1976-1985

<u>Company</u>	<u>1982</u>				<u>Year</u>
	<u>1st</u> <u>Qtr.</u>	<u>2nd</u> <u>Qtr.</u>	<u>3rd</u> <u>Qtr.</u>	<u>4th</u> <u>Qtr.</u>	
AMD	180	100	100	50	430
Electronic Arrays	0	0	0	0	0
Fairchild	30	5	0	0	35
Fujitsu	0	0	0	0	0
Intel	15	5	0	0	20
Mitsubishi	20	15	30	0	65
Motorola	200	160	250	150	760
National Semi.	70	50	50	50	220
Oki Electric	30	25	15	25	95
Texas Instruments	100	70	35	25	230
Toshiba	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total	645	430	480	300	1,855
Percentage Change from Previous Quarter	(27%)	(33%)	12%	(38%)	
Cumulative Total	55,455	55,885	56,365	56,665	
Average Selling Price	\$3.50	\$3.50	\$3.25	\$3.25	\$3.39
Revenue (\$M)	2.3	1.5	1.6	1.0	6.3
	<u>1982</u>				<u>Year</u>
	<u>1st</u> <u>Qtr.</u>	<u>2nd</u> <u>Qtr.</u>	<u>3rd</u> <u>Qtr.</u>	<u>4th</u> <u>Qtr.</u>	
Market Share					
U.S.	92.2%	90.7%	90.6%	91.7%	91.4%
Japan	7.8	9.3	9.4	8.3	8.6
Europe	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total	100.0%	100.0%	100.0%	100.0%	100.0%

(Continued)

MOS EPROM--Data

Table 1 (Continued)
8K MOS EPROM Shipment Data, 1976-1985

<u>Company</u>	<u>1983</u>				<u>Year</u>
	<u>1st</u> <u>Qtr.</u>	<u>2nd</u> <u>Qtr.</u>	<u>3rd</u> <u>Qtr.</u>	<u>4th</u> <u>Qtr.</u>	
AMD	100	100	50	50	300
Electronic Arrays	0	0	0	0	0
Fairchild	0	0	0	0	0
Fujitsu	0	0	0	0	0
Intel	0	0	0	0	0
Mitsubishi	0	0	0	0	0
Motorola	120	100	70	0	290
National Semi.	50	50	25	25	150
Oki Electric	0	0	0	0	0
Texas Instruments	0	0	0	0	0
Toshiba	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total	270	250	145	75	740
Percentage Change from Previous Quarter	(10%)	(7%)	(42%)	(48%)	
Cumulative Total	56,935	57,185	57,330	57,405	
Average Selling Price	\$3.50	\$4.00	\$4.00	\$4.25	\$3.84
Revenue (\$M)	0.9	1.0	0.6	0.3	2.8
	<u>1983</u>				<u>Year</u>
	<u>1st</u> <u>Qtr.</u>	<u>2nd</u> <u>Qtr.</u>	<u>3rd</u> <u>Qtr.</u>	<u>4th</u> <u>Qtr.</u>	
Market Share					
U.S.	100.0%	100.0%	100.0%	100.0%	100.0%
Japan	0	0	0	0	0
Europe	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total	100.0%	100.0%	100.0%	100.0%	100.0%

(Continued)

MOS EPROM--Data

Table 1 (Continued)
8K MOS EPROM Shipment Data, 1976-1985

<u>Company</u>	<u>1984</u>				<u>Year</u>
	<u>1st</u> <u>Qtr.</u>	<u>2nd</u> <u>Qtr.</u>	<u>3rd</u> <u>Qtr.</u>	<u>4th</u> <u>Qtr.</u>	
AMD	80	130	30	20	260
Electronic Arrays	0	0	0	0	0
Fairchild	0	0	0	0	0
Fujitsu	0	0	0	0	0
Intel	0	0	0	0	0
Mitsubishi	0	0	0	0	0
Motorola	0	0	0	0	0
National Semi.	25	0	0	0	25
Oki Electric	0	0	0	0	0
Texas Instruments	0	0	0	0	0
Toshiba	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total	105	130	30	20	285
Percentage Change from Previous Quarter	40%	24%	(77%)	(33%)	
Cumulative Total	57,510	57,640	57,670	57,690	
Average Selling Price	\$4.00	\$4.00	\$4.00	\$5.00	\$4.07
Revenue (\$M)	0.4	0.5	0.1	0.1	1.2
	<u>1984</u>				<u>Year</u>
	<u>1st</u> <u>Qtr.</u>	<u>2nd</u> <u>Qtr.</u>	<u>3rd</u> <u>Qtr.</u>	<u>4th</u> <u>Qtr.</u>	
Market Share					
U.S.	100.0%	100.0%	100.0%	100.0%	100.0%
Japan	0	0	0	0	0
Europe	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total	100.0%	100.0%	100.0%	100.0%	100.0%

(Continued)

MOS EPROM--Data

Table 1 (Continued)
8K MOS EPROM Shipment Data, 1976-1985

<u>Company</u>	<u>1985</u>				<u>Year</u>
	<u>1st</u> <u>Qtr.</u>	<u>2nd</u> <u>Qtr.</u>	<u>3rd</u> <u>Qtr.</u>	<u>4th</u> <u>Qtr.</u>	
AMD	15	10	5	5	35
Electronic Arrays	0	0	0	0	0
Fairchild	0	0	0	0	0
Fujitsu	0	0	0	0	0
Intel	0	0	0	0	0
Mitsubishi	0	0	0	0	0
Motorola	0	0	0	0	0
National Semi.	0	0	0	0	0
Oki Electric	0	0	0	0	0
Texas Instruments	0	0	0	0	0
Toshiba	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total	15	10	5	5	35
Percentage Change from Previous Quarter	(25%)	(33%)	(50%)	0	
Cumulative Total	57,705	57,715	57,720	57,725	
Average Selling Price	\$5.50	\$6.00	\$7.00	\$8.00	\$6.21
Revenue (\$M)	0.1	0.1	0	0	0.2
	<u>1985</u>				<u>Year</u>
	<u>1st</u> <u>Qtr.</u>	<u>2nd</u> <u>Qtr.</u>	<u>3rd</u> <u>Qtr.</u>	<u>4th</u> <u>Qtr.</u>	
Market Share					
U.S.	100.0%	100.0%	100.0%	100.0%	100.0%
Japan	0	0	0	0	0
Europe	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total	100.0%	100.0%	100.0%	100.0%	100.0%

Source: Dataquest
May 1989

MOS EPROM--Data

Table 2

16K MOS EPROM Shipment Data, 1976-1987

Company	MOS Process	1976				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	N/A	N/A	N/A	N/A	N/A
Eurotechnique	C	N/A	N/A	N/A	N/A	N/A
Fairchild	N	N/A	N/A	N/A	N/A	N/A
Fujitsu	N	N/A	N/A	N/A	N/A	N/A
Hitachi	N	N/A	N/A	N/A	N/A	N/A
Intel	N	N/A	N/A	S	10	10
Matsushita	N	N/A	N/A	N/A	N/A	N/A
Mitsubishi	N	N/A	N/A	N/A	N/A	N/A
Mostek	N	N/A	N/A	N/A	N/A	N/A
Motorola	N	N/A	N/A	N/A	N/A	N/A
National Semi.	N	N/A	N/A	N/A	N/A	N/A
	C	N/A	N/A	N/A	N/A	N/A
NEC	N	N/A	N/A	N/A	N/A	N/A
Oki Electric	N	N/A	N/A	N/A	N/A	N/A
SGS-Ates	N	N/A	N/A	N/A	N/A	N/A
Synertek	N	N/A	N/A	N/A	N/A	N/A
Texas Instruments	N	N/A	N/A	N/A	5	5
Toshiba	N	N/A	N/A	N/A	N/A	N/A
	N	0	0	0	15	15
	C	0	0	0	0	0
Total		0	0	0	15	15

Percentage Change from Previous Quarter

Cumulative Total	0	0	0	15	
ASPs: NMOS	\$50.00	\$50.00	\$50.00	\$50.00	\$50.00
CMOS	0	0	0	0	0
Overall	\$50.00	\$50.00	\$50.00	\$50.00	\$50.00
Revenue (\$M)	0	0	0	0.8	0.8

	1976				Year
	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
Market Share					
U.S.	0	0	0	100.0%	100.0%
Japan	0	0	0	0	0
Europe	0	0	0	0	0
Total	0	0	0	100.0%	100.0%

S = Sampling
N/A = Not Available

(Continued)

MOS EPROM--Data

Table 2 (Continued)

16K MOS EPROM Shipment Data, 1976-1987

<u>Company</u>	<u>MOS Process</u>	<u>1977</u>				<u>Year</u>
		<u>1st Qtr.</u>	<u>2nd Qtr.</u>	<u>3rd Qtr.</u>	<u>4th Qtr.</u>	
AMD	N	N/A	N/A	N/A	N/A	N/A
Eurotechnique	C	N/A	N/A	N/A	N/A	N/A
Fairchild	N	N/A	N/A	N/A	N/A	N/A
Fujitsu	N	N/A	N/A	N/A	N/A	N/A
Hitachi	N	N/A	N/A	N/A	N/A	N/A
Intel	N	40	75	100	125	340
Matsushita	N	N/A	N/A	N/A	N/A	N/A
Mitsubishi	N	N/A	N/A	N/A	N/A	N/A
Mostek	N	N/A	N/A	N/A	N/A	N/A
Motorola	N	N/A	N/A	N/A	N/A	N/A
National Semi.	N	N/A	N/A	N/A	N/A	N/A
	C	N/A	N/A	N/A	N/A	N/A
NEC	N	N/A	N/A	N/A	N/A	N/A
Oki Electric	N	N/A	N/A	N/A	N/A	N/A
SGS-Ates	N	N/A	N/A	N/A	N/A	N/A
Synertek	N	N/A	N/A	N/A	N/A	N/A
Texas Instruments	N	20	25	30	55	130
Toshiba	N	N/A	N/A	N/A	N/A	N/A
	N	60	100	130	180	470
	C	0	0	0	0	0
Total		60	100	130	180	470
Percentage Change from Previous Quarter		0	67%	30%	38%	
Cumulative Total		75	175	305	485	
ASPs: NMOS		\$45.00	\$45.00	\$30.00	\$30.00	\$35.11
CMOS		0	0	0	0	0
Overall		\$45.00	\$45.00	\$30.00	\$30.00	\$35.11
Revenue (\$M)		2.7	4.5	3.9	5.4	16.5
		<u>1977</u>				<u>Year</u>
		<u>1st Qtr.</u>	<u>2nd Qtr.</u>	<u>3rd Qtr.</u>	<u>4th Qtr.</u>	
Market Share						
U.S.		100.0%	100.0%	100.0%	100.0%	100.0%
Japan		0	0	0	0	0
Europe		0	0	0	0	0
Total		100.0%	100.0%	100.0%	100.0%	100.0%

N/A = Not Available

(Continued)

MOS EPROM--Data

Table 2 (Continued)

16K MOS EPROM Shipment Data, 1976-1987

Company	MOS Process	1978				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	N/A	N/A	N/A	N/A	0
Eurotechnique	C	N/A	N/A	N/A	N/A	0
Fairchild	N	N/A	N/A	N/A	N/A	0
Fujitsu	N	N/A	N/A	N/A	5	5
Hitachi	N	N/A	N/A	5	30	35
Intel	N	250	400	250	450	1,350
Matsushita	N	N/A	N/A	N/A	N/A	0
Mitsubishi	N	N/A	N/A	N/A	N/A	0
Mostek	N	S	S	S	25	25
Motorola	N	N/A	S	10	90	100
National Semi.	N	N/A	N/A	S	S	0
	C	N/A	N/A	N/A	N/A	0
NEC	N	N/A	N/A	N/A	N/A	0
Oki Electric	N	N/A	N/A	N/A	N/A	0
SGS-Ates	N	N/A	N/A	N/A	N/A	0
Synertek	N	N/A	N/A	N/A	N/A	0
Texas Instruments	N	100	250	200	300	850
Toshiba	N	N/A	N/A	S	S	5
	N	350	650	465	905	2,370
	C	0	0	0	0	0
Total		350	650	465	905	2,370
Percentage Change from Previous Quarter		94%	86%	(28%)	95%	
Cumulative Total		835	1,485	1,950	2,855	
ASPs:						
NMOS		\$28.00	\$25.00	\$25.00	\$15.00	\$21.62
CMOS		0	0	0	0	0
Overall		\$28.00	\$25.00	\$25.00	\$15.00	\$21.62
Revenue (\$M)		9.8	16.3	11.6	13.6	51.3
		1978				
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Year
Market Share						
U.S.		100.0%	100.0%	98.9%	95.6%	98.1%
Japan		0	0	1.1	4.4	1.9
Europe		0	0	0	0	0
Total		100.0%	100.0%	100.0%	100.0%	100.0%

S = Sampling
N/A = Not Available

(Continued)

MOS EPROM--Data

Table 2 (Continued)

16K MOS EPROM Shipment Data, 1976-1987

Company	MOS Process	1979				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	N/A	S	5	10	15
Eurotechnique	C	N/A	N/A	N/A	N/A	0
Fairchild	N	N/A	N/A	N/A	N/A	0
Fujitsu	N	70	200	300	300	870
Hitachi	N	125	200	350	500	1,175
Intel	N	550	750	800	900	3,000
Matsushita	N	N/A	N/A	N/A	N/A	0
Mitsubishi	N	10	20	50	90	170
Mostek	N	90	150	250	350	840
Motorola	N	160	150	160	200	670
National Semi.	N	5	50	80	120	255
	C	N/A	N/A	N/A	N/A	0
NEC	N	N/A	N/A	N/A	5	5
Oki Electric	N	N/A	N/A	N/A	N/A	0
SGS-Ates	N	N/A	N/A	N/A	N/A	0
Synertek	N	N/A	N/A	N/A	S	0
Texas Instruments	N	400	900	1,100	1,800	4,200
Toshiba	N	25	50	90	200	365
	N	1,435	2,470	3,185	4,475	11,565
	C	0	0	0	0	0
Total		1,435	2,470	3,185	4,475	11,565
Percentage Change from Previous Quarter		59%	72%	29%	41%	
Cumulative Total		4,290	6,760	9,945	14,420	
ASPs: NMOS		\$17.00	\$22.00	\$19.00	\$17.00	\$18.62
CMOS		0	0	0	0	0
Overall		\$17.00	\$22.00	\$19.00	\$17.00	\$18.62
Revenue (\$M)		24.4	54.3	60.5	76.1	215.3
		1979				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
Market Share						
U.S.		84.0%	81.0%	75.2%	75.5%	77.6%
Japan		16.0	19.0	24.8	24.5	22.4
Europe		0	0	0	0	0
Total		100.0%	100.0%	100.0%	100.0%	100.0%

S = Sampling
N/A = Not Available

(Continued)

MOS EPROM--Data

Table 2 (Continued)

16K MOS EPROM Shipment Data, 1976-1987

Company	MOS Process	1980				
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Year
AMD	N	25	50	100	175	350
Eurotechnique	C	N/A	N/A	N/A	N/A	0
Fairchild	N	30	300	300	250	880
Fujitsu	N	350	750	700	650	2,450
Hitachi	N	700	850	1,025	1,325	3,900
Intel	N	950	1,000	1,700	1,850	5,500
Matsushita	N	5	50	50	80	180
Mitsubishi	N	210	260	270	410	1,150
Mostek	N	275	250	350	450	1,325
Motorola	N	250	350	500	500	1,600
National Semi.	N	250	250	300	425	1,225
NEC	C	N/A	N/A	N/A	N/A	0
NEC	N	10	25	50	125	210
Oki Electric	N	5	0	0	0	0
SGS-Ates	N	1,800	0	0	5	1,805
Synertek	N	200	25	10	0	235
Texas Instruments	N	2,000	2,000	2,000	2,100	8,100
Toshiba	N	300	330	350	400	1,380
	N	7,350	6,490	7,705	8,745	30,290
	C	0	0	0	0	0
Total		7,350	6,490	7,705	8,745	30,290
Percentage Change from Previous Quarter:						
		64%	(12%)	19%	13%	
Cumulative Total		21,770	28,260	35,965	44,710	
ASPs:						
NMOS		\$15.00	\$11.00	\$8.00	\$6.00	\$9.76
CMOS		0	0	0	0	0
Overall		\$15.00	\$11.00	\$8.00	\$6.00	\$9.76
Revenue (\$M)		110.3	71.4	61.6	52.5	295.8
Market Share						
U.S.		54.1%	65.1%	68.3%	65.8%	63.4%
Japan		21.4	34.9	31.7	34.2	30.6
Europe		24.5	0	0	0.1	6.0
Total		100.0%	100.0%	100.0%	100.0%	100.0%

\$ • Sampling

N/A = Not Available

Note: Columns may not add to totals shown because of rounding.

(Continued)

MOS EPROM--Data

Table 2 (Continued)

16K MOS EPROM Shipment Data, 1976-1987

Company	MOS Process	1981				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	250	350	485	750	1,835
Eurotechnique	C	N/A	N/A	S	15	15
Fairchild	N	100	20	20	0	140
Fujitsu	N	750	1,000	700	500	2,950
Hitachi	N	1,700	1,700	1,200	700	5,300
Intel	N	2,600	3,000	3,000	3,000	11,600
Matsushita	N	120	150	200	250	720
Mitsubishi	N	580	740	670	520	2,510
Mostek	N	700	600	700	800	2,800
Motorola	N	400	420	500	400	1,720
National Semi.	N	500	550	700	1,100	2,850
	C	N/A	N/A	N/A	N/A	N/A
NEC	N	175	250	600	900	1,925
Oki Electric	N	25	40	80	100	245
SGS-Ates	N	15	25	50	75	165
Synertek	N	0	0	0	0	0
Texas Instruments	N	2,200	2,500	2,200	2,200	9,100
Toshiba	N	90	100	200	350	740
	N	10,205	11,445	11,305	11,645	44,600
	C	0	0	0	15	15
Total		10,205	11,445	11,305	11,660	44,615
Percentage Change from Previous Quarter						
		17%	12%	(1%)	3%	
Cumulative Total		54,915	66,360	77,665	89,325	
ASPs:						
NMOS		\$4.50	\$3.50	\$3.00	\$2.50	\$3.34
CMOS		0	0	0	0	0
Overall		\$4.50	\$3.50	\$3.00	\$2.50	\$3.34
Revenue (\$M)		45.9	40.1	33.9	29.1	149.0
Market Share						
U.S.		66.1%	65.0%	67.3%	70.8%	67.3%
Japan		33.7	34.8	32.3	28.5	32.3
Europe		0.1	0.2	0.4	0.8	0.4
Total		100.0%	100.0%	100.0%	100.0%	100.0%

S = Sampling

N/A = Not Available

Note: Columns may not add to totals shown because of rounding.

(Continued)

MOS EPROM--Data

Table 2 (Continued)

16K MOS EPROM Shipment Data, 1976-1987

Company	MOS Process	1982				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	1,000	1,150	1,150	900	4,200
Eurotechnique	C	100	400	500	600	1,600
Fairchild	N	0	0	0	0	0
Fujitsu	N	400	350	250	100	1,100
Hitachi	N	450	250	200	200	1,100
Intel	N	3,000	2,500	1,800	1,200	8,500
Matsushita	N	250	250	150	100	750
Mitsubishi	N	450	350	300	160	1,260
Mostek	N	500	200	250	250	1,200
Motorola	N	250	160	100	60	570
National Semi.	N	1,200	1,250	1,300	2,200	5,950
	C	50	150	200	200	600
NEC	N	900	1,000	1,200	1,200	4,300
Oki Electric	N	250	400	400	400	1,450
SGS-Ates	N	100	180	350	520	1,150
Synertek	N	0	0	0	0	0
Texas Instruments	N	2,000	2,000	1,800	1,800	7,600
Toshiba	N	500	400	300	300	1,500
	N	11,250	10,440	9,550	9,390	40,630
	C	150	550	700	800	2,200
Total		11,400	10,990	10,250	10,190	42,830
Percentage Change from Previous Quarter						
		(2%)	(4%)	(7%)	(1%)	
Cumulative Total		100,725	111,715	121,965	132,155	
ASPs: NMOS		\$3.25	\$3.10	\$3.00	\$3.00	\$3.09
CMOS		0	0	0	0	0
Overall		\$3.25	\$3.10	\$3.00	\$3.00	\$3.09
Revenue (\$M)		36.6	32.4	28.7	28.2	125.7
Market Share						
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Year
U.S.		70.2%	67.4%	64.4%	64.9%	66.8%
Japan		28.1	27.3	27.3	24.1	26.8
Europe		1.8	5.3	8.3	11.0	6.4
Total		100.0%	100.0%	100.0%	100.0%	100.0%

Note: Columns may not add to totals shown because of rounding.

(Continued)

MOS EPROM--Data

Table 2 (Continued)

16K MOS EPROM Shipment Data, 1976-1987

Company	MOS Process	1983				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	700	700	1,000	1,200	3,600
Eurotechnique	C	200	200	200	200	800
Fairchild	N	0	0	0	0	0
Fujitsu	N	50	50	0	0	100
Hitachi	N	100	100	50	0	250
Intel	N	1,000	1,000	800	700	3,500
Matsushita	N	100	100	100	100	400
Mitsubishi	N	180	120	160	130	590
Mostek	N	200	150	150	50	550
Motorola	N	50	80	30	0	160
National Semi.	N	2,150	2,500	2,500	2,800	9,950
	C	350	500	500	700	2,050
NEC	N	2,000	2,500	2,700	1,500	8,700
Oki Electric	N	400	400	350	350	1,500
SGS-Ates	N	500	800	800	900	3,000
Synartek	N	0	0	0	0	0
Texas Instruments	N	2,000	2,500	3,000	3,000	10,500
Toshiba	N	200	100	100	100	500
	N	9,630	11,100	11,740	10,830	43,300
	C	550	700	700	900	2,850
Total		10,180	11,800	12,440	11,730	46,150
Percentage Change from Previous Quarter		0%	16%	5%	(6%)	
Cumulative Total		142,335	154,135	166,575	178,305	
ASPs:						
NMOS		\$3.00	\$3.15	\$3.25	\$3.35	\$3.19
CMOS		0	0	0	0	0
Overall		\$3.00	\$3.15	\$3.25	\$3.35	\$3.19
Revenue (\$M)		28.9	35.0	38.2	36.3	138.3
		1983				
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Year
Market Share						
U.S.		63.4%	63.0%	64.1%	72.0%	65.7%
Japan		29.8	28.6	27.8	18.6	26.1
Europe		6.9	8.5	8.0	9.4	8.2
Total		100.0%	100.0%	100.0%	100.0%	100.0%

Note: Columns may not add to totals shown because of rounding.

(Continued)

MOS EPROM--Data

Table 2 (Continued)
16K MOS EPROM Shipment Data, 1976-1987

Company	MOS Process	1984				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	1,000	1,100	1,200	1,300	4,600
Fairchild	N	0	0	0	0	0
Fujitsu	N	0	0	0	0	0
Hitachi	N	0	0	0	0	0
Intel	N	300	150	100	50	600
Matsushita	N	50	50	25	0	125
Mitsubishi	N	130	130	130	100	490
Mostek	N	0	0	0	0	0
Motorola	N	0	0	0	0	0
National Semi.	N	2,800	2,700	2,400	2,000	9,900
	C	700	700	550	400	2,350
NEC	N	1,350	1,200	950	700	4,200
Oki Electric	N	250	250	200	200	900
SGS	N	1,050	600	300	800	2,750
Synertek	N	0	0	0	0	0
Texas Instruments	N	3,500	3,000	2,000	1,800	10,300
Thomson-Eurotechnique	C	200	250	250	250	950
Toshiba	N	0	0	0	0	0
	N	10,430	9,180	7,305	6,950	33,865
	C	900	950	800	650	3,300
Total		11,330	10,130	8,105	7,600	37,165
Percentage Change from Previous Quarter						
		(3%)	(11%)	(20%)	(6%)	
Cumulative Total		189,635	199,765	207,870	215,470	
ASPs:	NMOS	\$3.35	\$3.35	\$3.00	\$2.85	\$3.17
	CMOS	\$5.50	\$5.50	\$5.25	\$4.50	\$5.24
	Overall	\$3.52	\$3.55	\$3.22	\$2.99	\$3.36
Revenue (\$M)		39.9	36.0	26.1	22.7	124.7
Market Share						
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Year
U.S.		73.3%	75.5%	77.1%	73.0%	74.7%
Japan		15.7	16.1	16.1	13.2	15.4
Europe		11.0	8.4	6.8	13.8	10.0
Total		100.0%	100.0%	100.0%	100.0%	100.0%

Note: Columns may not add to totals shown because of rounding.

(Continued)

MOS EPROM--Data

Table 2 (Continued)

16K MOS EPROM Shipment Data, 1976-1987

Company	MOS Process	1985				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	1,550	1,850	1,350	1,050	5,800
Fairchild	N	0	0	0	0	0
Fujitsu	N	0	0	0	0	0
Hitachi	N	0	0	0	0	0
Intel	N	0	0	0	0	0
Matsushita	N	0	0	0	0	0
Mitsubishi	N	50	50	0	0	100
Mostek	N	0	0	0	0	0
Motorola	N	0	0	0	0	0
National Semi.	N	1,800	1,600	1,500	1,200	6,100
NEC	C	400	350	400	500	1,650
	N	400	250	800	270	1,720
Oki Electric	N	150	150	100	100	500
SGS	N	750	800	1,100	1,200	3,850
Synertek	N	0	0	0	0	0
Texas Instruments	N	1,500	1,500	1,600	1,600	6,200
Thomson-Eurotechnique	C	350	450	400	500	1,700
Toshiba	N	0	0	0	0	0
	N	6,200	6,200	6,450	5,420	24,270
	C	750	800	800	1,000	3,350
Total		6,950	7,000	7,250	6,420	27,620
Percentage Change from Previous Quarter						
		(9%)	1%	4%	(11%)	
Cumulative Total		222,420	229,420	236,670	243,090	
ASPs:	NMOS	\$2.60	\$2.40	\$2.25	\$2.25	\$2.38
	CMOS	\$4.00	\$3.50	\$3.25	\$3.25	\$3.48
	Overall	\$2.75	\$2.53	\$2.36	\$2.41	\$2.51
Revenue (\$M)		19.1	17.7	17.1	15.4	69.4
Market Share						
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Year
U.S.		75.5%	75.7%	66.9%	67.8%	71.5%
Japan		8.6	6.4	12.4	5.8	8.4
Europe		15.8	17.9	20.7	26.5	20.1
Total		100.0%	100.0%	100.0%	100.0%	100.0%

Note: Columns may not add to totals shown because of rounding.

(Continued)

MOS EPROM--Data

Table 2 (Continued)

16K MOS EPROM Shipment Data, 1976-1987

Company	MOS Process	1986				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	1,000	600	450	375	2,425
Intel	N	250	250	250	250	1,000
National Semi.	N	1,500	1,200	950	800	4,450
NEC	N	180	220	80	40	520
SGS	N	356	189	600	400	1,545
Texas Instruments	N	750	750	400	200	2,100
Thomson	N	1,000	600	600	425	2,625
	N	5,036	3,809	3,330	2,490	14,665
	C	0	0	0	0	0
Total		5,036	3,809	3,330	2,490	14,665
Percentage Change from Previous Quarter						
		(22%)	(24%)	(13%)	(25%)	
Cumulative Total		248,126	251,935	255,265	257,755	
ASPs:	NMOS	\$2.35	\$2.40	\$2.40	\$2.50	\$2.40
	CMOS	0	0	0	0	0
	Overall	\$2.35	\$2.40	\$2.40	\$2.50	\$2.40
Revenue (\$M)		11.8	9.1	8.0	6.2	35.2
Market Share						
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Year
U.S.		69.5%	73.5%	61.6%	65.3%	68.0%
Japan		3.6	5.8	2.4	1.6	3.5
Europe		26.9	20.7	36.0	33.1	28.4
Total		100.0%	100.0%	100.0%	100.0%	100.0%

Note: Columns may not add to totals shown because of rounding.

(Continued)

MOS EPROM--Data

Table 2 (Continued)

16K MOS EPROM Shipment Data, 1976-1987

Company	MOS Process	1987				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	500	300	300	290	1,390
Cypress	C	150	200	200	350	900
Intel	N	200	200	200	200	800
National Semi.	C	158	227	204	195	784
NEC	N	40	40	50	30	160
SGS-Thomson	N	1,185	1,125	1,240	720	4,270
	C	15	70	30	75	190
Texas Instruments	N	200	200	150	150	700
	C	50	50	110	125	335
WaferScale	C	10	25	75	75	185
	N	2,125	1,865	1,940	1,390	7,320
	C	383	572	619	820	2,394
Total		2,508	2,437	2,559	2,210	9,714
Percentage Change from Previous Quarter		1%	(3%)	5%	(14%)	
Cumulative Total		260,263	262,700	265,259	267,469	
ASPs:	NMOS	\$2.55	\$2.60	\$2.65	\$2.70	\$2.62
	CMOS	\$4.60	\$2.90	\$3.10	\$3.30	\$3.36
	Overall	\$2.86	\$2.67	\$2.76	\$2.92	\$2.80
Revenue (\$M)		7.2	6.5	7.1	6.5	27.2
		1987				
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Year
Market Share						
U.S.		50.6%	49.3%	48.4%	62.7%	52.4%
Japan		1.6	1.6	2.0	1.3	1.6
Europe		47.8	49.0	49.6	36.0	45.9
Total		100.0%	100.0%	100.0%	100.0%	100.0%

Note: Columns may not add to totals shown because of rounding.

Source: Dataquest
May 1989

MOS EPROM--Data

Table 3

32K MOS EPROM Shipment Data, 1978-1987

Company	MOS Process	1978				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	N/A	N/A	N/A	N/A	0
Eurotechnique	C	N/A	N/A	N/A	N/A	0
Fujitsu	N	N/A	N/A	N/A	N/A	0
	C	N/A	N/A	N/A	N/A	0
Hitachi	N	N/A	N/A	N/A	N/A	0
Intel	N	N/A	N/A	N/A	S	0
Mitsubishi	N	N/A	N/A	N/A	N/A	0
Motorola	N	N/A	N/A	N/A	N/A	0
National Semi.	C	N/A	N/A	N/A	N/A	0
NEC	N	N/A	N/A	N/A	N/A	0
Ricoh	C	N/A	N/A	N/A	N/A	0
Rockwell	N	N/A	N/A	N/A	N/A	0
	C	N/A	N/A	N/A	N/A	0
SGS-Ates	N	N/A	N/A	N/A	N/A	0
Texas Instruments	N	N/A	N/A	N/A	S	5
Toshiba	N	N/A	N/A	N/A	N/A	0
	N	0	0	0	5	5
	C	0	0	0	0	0
Total		0	0	0	5	5
Percentage Change from Previous Quarter		0	0	0	0	
Cumulative Total		0	0	0	5	
ASPs: NMOS		0	0	0	0	\$80.00
CMOS		0	0	0	0	0
Overall		0	0	0	0	\$80.00
Revenue (\$M)		0	0	0	0	0
		1978				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
Market Share						
U.S.		0	0	0	0	0
Japan		0	0	0	0	0
Europe		0	0	0	0	0
Total		0	0	0	0	0

S = Sampling
N/A = Not Available

(Continued)

MOS EPROM--Data

Table 3 (Continued)
32K MOS EPROM Shipment Data, 1978-1987

Company	MOS Process	1979				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	N/A	N/A	N/A	N/A	0
Eurotechnique	C	N/A	N/A	N/A	N/A	0
Fujitsu	N	N/A	N/A	N/A	S	0
	C	N/A	N/A	N/A	N/A	0
Hitachi	N	N/A	N/A	N/A	S	0
Intel	N	5	30	50	100	185
Mitsubishi	N	N/A	N/A	N/A	S	0
Motorola	N	N/A	N/A	N/A	S	0
National Semi.	C	N/A	N/A	N/A	N/A	0
NEC	N	N/A	N/A	N/A	N/A	0
Ricoh	C	N/A	N/A	N/A	N/A	0
Rockwell	N	N/A	N/A	N/A	N/A	0
	C	N/A	N/A	N/A	N/A	0
SGS-Ates	N	N/A	N/A	N/A	N/A	0
Texas Instruments	N	10	35	60	90	195
Toshiba	N	N/A	N/A	N/A	N/A	0
	N	15	65	110	190	380
	C	0	0	0	0	0
Total		15	65	110	190	380
Percentage Change from Previous Quarter						
		0	333%	69%	73%	
Cumulative Total						
		20	85	195	385	
ASPs: NMOS		\$80.00	\$80.00	\$75.00	\$75.00	\$76.05
CMOS		0	0	0	0	0
Overall		\$80.00	\$80.00	\$75.00	\$75.00	\$76.05
Revenue (\$M)						
		1.2	5.2	8.3	14.3	28.9
Market Share						
		100.0%	100.0%	100.0%	100.0%	100.0%
U.S.		0	0	0	0	0
Japan		0	0	0	0	0
Europe		0	0	0	0	0
Total		100.0%	100.0%	100.0%	100.0%	100.0%

S = Sampling
N/A = Not Available

(Continued)

MOS EPROM--Data

Table 3 (Continued)

32K MOS EPROM Shipment Data, 1978-1987

Company	MOS Process	1980				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	N/A	N/A	S	2	2
Eurotechnique	C	N/A	N/A	N/A	N/A	0
Fujitsu	N	S	S	15	100	115
	C	N/A	N/A	N/A	N/A	0
Hitachi	N	S	120	220	280	620
Intel	N	165	250	325	450	1,190
Mitsubishi	N	S	6	40	90	136
Motorola	N	S	30	60	50	145
National Semi.	C	S	10	15	15	40
NEC	N	N/A	N/A	5	15	20
Ricoh	C	N/A	N/A	N/A	N/A	0
Rockwell	N	N/A	N/A	N/A	N/A	0
	C	N/A	N/A	N/A	N/A	0
SGS-Ates	N	N/A	N/A	N/A	N/A	0
Texas Instruments	N	150	300	350	450	1,250
Toshiba	N	N/A	S	5	10	15
	N	320	706	1,020	1,447	3,493
	C	0	20	15	15	40
Total		320	716	1,035	1,462	3,533
Percentage Change from Previous Quarter		68%	124%	45%	41%	
Cumulative Total		705	1,421	2,456	3,918	
ASPs: NMOS		\$55.00	\$40.00	\$30.00	\$10.00	\$26.03
CMOS		0	0	0	0	0
Overall		\$55.00	\$40.00	\$30.00	\$10.00	\$26.03
Revenue (\$M)		17.6	28.2	30.6	14.5	90.9
		1980				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
Market Share						
U.S.		100.0%	82.4%	72.5%	66.1%	74.4%
Japan		0	17.6	27.5	33.9	25.6
Europe		0	0	0	0	0
Total		100.0%	100.0%	100.0%	100.0%	100.0%

S = Sampling
N/A = Not Available

(Continued)

MOS EPROM--Data

Table 3 (Continued)

32K MOS EPROM Shipment Data, 1978-1987

Company	MOS Process	1981				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	10	100	120	310	540
Eurotechnique	C	N/A	N/A	S	S	5
Fujitsu	N	150	170	600	1,000	1,920
	C	N/A	N/A	N/A	N/A	0
Hitachi	N	500	600	900	1,050	3,050
Intel	N	600	700	1,050	1,600	3,950
Mitsubishi	N	190	270	270	660	1,390
Motorola	N	50	120	250	350	770
National Semi.	C	10	20	30	30	90
NEC	N	30	50	325	700	1,105
Ricoh	C	N/A	N/A	N/A	N/A	0
Rockwell	N	N/A	N/A	N/A	N/A	0
	C	N/A	N/A	N/A	N/A	0
SGS-Ates	N	N/A	N/A	N/A	N/A	0
Texas Instruments	N	560	700	900	1,000	3,160
Toshiba	N	10	25	100	180	315
	N	2,100	2,735	4,515	6,850	16,200
	C	10	20	30	35	95
Total		2,110	2,755	4,545	6,885	16,295
Percentage Change from Previous Quarter		44%	31%	65%	51%	
Cumulative Total		6,028	8,783	13,328	20,213	
ASPs: NMOS		\$9.00	\$8.00	\$7.00	\$5.80	\$6.92
CMOS		0	0	0	0	0
Overall		\$9.00	\$8.00	\$7.00	\$5.80	\$6.92
Revenue (\$M)		18.9	21.9	31.6	39.7	112.1
		1981				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
Market Share						
U.S.		58.3%	59.5%	51.7%	47.8%	52.2%
Japan		41.7	40.5	48.3	52.1	47.7
Europe		0	0	0	0	0
Total		100.0%	100.0%	100.0%	100.0%	100.0%

S = Sampling

N/A = Not Available

Note: Columns may not add to totals shown because of rounding.

(Continued)

MOS EPROM--Data

Table 3 (Continued)
32K MOS EPROM Shipment Data, 1978-1987

Company	MOS Process	1982				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	600	1,050	650	850	3,150
Eurotechnique	C	30	100	150	200	480
Fujitsu	N	600	700	1,000	1,200	3,500
	C	N/A	N/A	N/A	S	0
Hitachi	N	1,500	2,500	2,500	2,500	9,000
Intel	N	2,000	2,500	2,500	2,500	9,500
Mitsubishi	N	1,450	1,500	1,800	1,500	6,250
Motorola	N	325	100	100	0	525
National Semi.	C	75	100	220	250	645
NEC	N	1,300	1,600	2,200	2,300	7,400
Ricoh	C	N/A	N/A	N/A	N/A	0
Rockwell	N	N/A	N/A	N/A	N/A	0
	C	N/A	N/A	N/A	N/A	0
SGS-Ates	N	S	10	25	50	85
Texas Instruments	N	500	600	700	900	2,700
Toshiba	N	300	400	600	600	1,900
	N	8,575	10,960	12,075	12,400	44,010
	C	105	200	370	450	1,125
Total		8,680	11,160	12,445	12,850	45,135
Percentage Change from Previous Quarter		26%	29%	12%	3%	
Cumulative Total		28,893	40,053	52,498	65,348	
ASPs: NMOS		\$6.00	\$5.50	\$5.00	\$4.75	\$5.25
CMOS		0	0	0	0	0
Overall		\$6.00	\$5.50	\$5.00	\$4.75	\$5.25
Revenue (\$M)		51.5	60.3	60.4	58.9	231.0
		1982				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
Market Share						
U.S.		40.3%	39.0%	33.5%	35.0%	36.6%
Japan		59.3	60.0	65.1	63.0	62.1
Europe		0.3	1.0	1.4	1.9	1.3
Total		100.0%	100.0%	100.0%	100.0%	100.0%

S = Sampling

N/A = Not Available

Note: Columns may not add to totals shown because of rounding.

(Continued)

MOS EPROM--Data

Table 3 (Continued)

32K MOS EPROM Shipment Data, 1978-1987

Company	MOS Process	1983				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	800	1,000	1,200	1,500	4,500
Eurotechnique	C	200	300	400	400	1,300
Fujitsu	N	1,200	1,500	1,500	1,500	5,700
	C	10	25	50	50	135
Hitachi	N	3,000	3,500	3,500	3,000	13,000
Intel	N	2,500	2,500	2,200	1,800	9,000
Mitsubishi	N	1,600	1,700	1,500	1,300	6,100
Motorola	N	0	0	0	0	0
National Semi.	C	350	450	600	800	2,200
NEC	N	2,400	2,500	1,700	1,700	8,300
Ricoh	C	N/A	N/A	N/A	S	0
Rockwell	N	N/A	N/A	N/A	N/A	0
	C	N/A	N/A	S	25	25
SGS-Ates	N	50	100	100	100	350
Texas Instruments	N	1,000	2,000	3,000	3,500	9,500
Toshiba	N	600	400	500	500	2,000
	N	13,150	15,200	15,200	14,900	58,450
	C	560	775	1,050	1,275	3,660
Total		13,710	15,975	16,250	16,175	62,110
Percentage Change from Previous Quarter		7%	17%	2%	0%	
Cumulative Total		79,058	95,033	111,283	127,458	
ASPs: NMOS		\$4.50	\$4.00	\$3.75	\$3.75	\$3.98
CMOS		0	0	0	0	0
Overall		\$4.50	\$4.00	\$3.75	\$3.75	\$3.98
Revenue (\$M)		59.2	60.8	57.0	55.9	232.9
		1983				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
Market Share						
U.S.		33.9%	37.2%	43.1%	47.1%	40.6%
Japan		64.3	60.3	53.8	49.8	56.7
Europe		1.8	2.5	3.1	3.1	2.7
Total		100.0%	100.0%	100.0%	100.0%	100.0%

S = Sampling
N/A = Not Available

(Continued)

MOS EPROM--Data

Table 3 (Continued)

32K MOS EPROM Shipment Data, 1978-1987

Company	MOS Process	1984				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	1,600	1,800	2,200	2,200	7,800
Fujitsu	N	1,600	1,800	1,500	1,200	6,100
	C	150	250	250	250	900
Hitachi	N	2,500	2,000	1,500	1,200	7,200
Intel	N	1,800	1,800	2,000	2,000	7,600
Mitsubishi	N	1,100	900	650	400	3,050
Motorola	N	0	0	0	0	0
National Semi.	C	900	1,000	1,100	850	3,850
NEC	N	1,400	1,550	1,000	750	4,700
Ricoh	C	S	S	50	100	150
Rockwell	N	N/A	N/A	S	S	0
	C	50	25	0	0	75
SGS	N	200	350	600	1,000	2,150
Texas Instruments	N	3,800	4,000	3,200	2,200	13,200
Thomson-Eurotechnique	C	350	300	300	250	1,200
Toshiba	N	300	150	50	25	525
	N	14,300	14,350	12,700	10,975	52,325
	C	1,450	1,575	1,700	1,450	6,175
Total		15,750	15,925	14,400	12,425	58,500
Percentage Change from Previous Quarter						
		(3%)	1%	(10%)	(14%)	
Cumulative Total		143,208	159,133	173,533	185,958	
ASPs: NMOS		\$3.60	\$3.50	\$3.25	\$3.10	\$3.38
CMOS		\$7.50	\$7.50	\$7.25	\$7.00	\$7.31
Overall		\$3.96	\$3.90	\$3.72	\$3.56	\$3.80
Revenue (\$M)		62.4	62.0	53.6	44.2	222.2
Market Share						
U.S.		51.7%	54.2%	59.0%	58.4%	55.6%
Japan		44.8	41.8	34.7	31.6	38.7
Europe		3.5	4.1	6.3	10.1	5.7
Total		100.0%	100.0%	100.0%	100.0%	100.0%

S = Sampling

N/A = Not Available

Note: Columns may not add to totals shown because of rounding.

(Continued)

MOS EPROM--Data

Table 3 (Continued)

32K MOS EPROM Shipment Data, 1978-1987

Company	MOS Process	1985				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	2,200	2,450	1,750	1,300	7,700
Fujitsu	N	800	600	300	250	1,950
	C	250	250	250	150	900
Hitachi	N	900	700	400	400	2,400
Intel	N	1,800	1,500	1,500	1,500	6,300
Mitsubishi	N	650	1,000	450	300	2,400
Motorola	N	0	0	0	0	0
National Semi.	C	700	600	500	500	2,300
NEC	N	730	500	800	530	2,560
Ricoh	C	150	200	200	150	700
Rockwell	N	50	50	0	0	100
	C	0	0	0	0	0
SGS	N	800	700	850	1,000	3,350
Texas Instruments	N	1,800	1,600	1,500	1,200	6,100
Thomson-Eurotechnique	C	350	400	400	400	1,550
Toshiba	N	0	0	0	0	0
	N	9,730	9,100	7,550	6,480	32,860
	C	1,450	1,450	1,350	1,200	5,450
Total		11,180	10,550	8,900	7,680	38,310
Percentage Change from Previous Quarter						
		(10%)	(6%)	(16%)	(14%)	
Cumulative Total		197,138	207,688	216,588	224,268	
ASPs:	NMOS	\$2.80	\$2.25	\$2.20	\$2.20	\$2.39
	CMOS	\$5.50	\$4.50	\$3.50	\$2.80	\$4.14
	Overall	\$3.15	\$2.56	\$2.40	\$2.29	\$2.64
Revenue (\$M)		35.2	27.0	21.3	17.6	101.2
Market Share						
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Year
U.S.		58.6%	58.8%	59.0%	58.6%	58.7%
Japan		31.1	30.8	27.0	23.2	28.5
Europe		10.3	10.4	14.0	18.2	12.8
Total		100.0%	100.0%	100.0%	100.0%	100.0%

(Continued)

MOS EPROM--Data

Table 3 (Continued)

32K MOS EPROM Shipment Data, 1978-1987

Company	MOS Process	1986				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	950	850	675	450	2,925
Fujitsu	N	150	50	0	0	200
	C	50	0	0	0	50
Hitachi	N	500	200	100	50	850
Intel	N	1,300	1,300	1,000	1,550	5,150
	OTP	250	250	250	100	850
Mitsubishi	N	0	0	282	7	289
National Semi.	C	400	300	300	300	1,300
NEC	N	330	270	150	100	850
Ricoh	C	50	50	0	0	100
SGS	N	463	350	1,200	1,200	3,213
Texas Instruments	N	1,000	1,000	1,100	1,500	4,600
Thomson-Eurotechnique	C	300	300	300	300	1,200
	N	4,943	4,270	4,757	4,957	18,927
	C	800	650	600	600	2,650
Total		5,743	4,920	5,357	5,557	21,577
Percentage Change from Previous Quarter		(25%)	(14%)	9%	4%	
Cumulative Total		230,011	234,931	240,288	245,845	
ASPs: NMOS		\$2.10	\$2.15	\$2.20	\$2.25	\$2.18
CMOS		\$2.50	\$2.75	\$2.80	\$2.85	\$2.71
Overall		\$2.16	\$2.23	\$2.27	\$2.31	\$2.24
Revenue (\$M)		12.4	11.0	12.1	12.9	48.4
		1986				
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Year
Market Share						
U.S.		67.9%	75.2%	62.1%	70.2%	68.7%
Japan		18.8	11.6	9.9	2.8	10.8
Europe		13.3	13.2	28.0	27.0	20.5
Total		100.0%	100.0%	100.0%	100.0%	100.0%

(Continued)

MOS EPROM--Data

Table 3 (Continued)

32K MOS EPROM Shipment Data, 1978-1987

Company	MOS Process	1987				
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Year
AMD	N	400	450	475	510	1,835
Fujitsu	N	0	0	0	0	0
	C	0	0	0	0	0
Hitachi	N	0	0	0	0	0
Intel	N	1,050	1,300	1,100	1,100	4,550
	OTP	0	0	0	0	0
Mitsubishi	N	0	0	0	0	0
National Semi.	C	750	750	744	628	2,872
NEC	N	100	20	20	10	150
Ricoh	C	0	0	0	0	0
SGS-Thomson	N	685	550	470	560	2,265
	C	75	65	50	45	235
Texas Instruments	N	1,500	1,000	1,000	800	4,300
	N	3,735	3,320	3,065	2,980	13,100
	C	825	815	794	673	3,107
Total		4,560	4,135	3,859	3,653	16,207
Percentage Change from Previous Quarter		(18%)	(9%)	(7%)	(5%)	
Cumulative Total		250,405	254,540	258,399	262,052	
ASPs:	NMOS	\$2.50	\$2.75	\$2.90	\$3.00	\$2.77
	CMOS	\$2.90	\$3.00	\$3.20	\$3.25	\$3.08
	Overall	\$2.57	\$2.80	\$2.96	\$3.05	\$2.83
Revenue (\$M)		11.7	11.6	11.4	11.1	45.9
		1987				
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Year
Market Share						
U.S.		81.1%	84.6%	86.0%	83.2%	83.6%
Japan		2.2	0.5	0.5	0.3	0.9
Europe		16.7	14.9	13.5	16.6	15.4
Total		100.0%	100.0%	100.0%	100.0%	100.0%

Note: Columns may not add to totals shown because of rounding.

Source: Dataquest
May 1989

MOS EPROM--Data

Table 4

64K MOS EPROM Shipment Data, 1980-1987

Company	MOS Process	1980				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	N/A	N/A	N/A	N/A	0
Pujitsu	N	N/A	N/A	N/A	N/A	0
	C	N/A	N/A	N/A	N/A	0
Hitachi	N	N/A	N/A	N/A	S	0
	C	N/A	N/A	N/A	N/A	0
Intel	N	N/A	N/A	N/A	S	0
	N	N/A	N/A	N/A	N/A	0
Mitsubishi	N	N/A	N/A	N/A	N/A	0
Mostek	N	N/A	N/A	N/A	S	0
Motorola	N	S	S	S	S	10
NEC	N	N/A	N/A	N/A	N/A	0
	C	N/A	N/A	N/A	N/A	0
Oki Electric	N	N/A	N/A	N/A	N/A	0
Ricoh	C	N/A	N/A	N/A	N/A	0
Rockwell	N	N/A	N/A	N/A	N/A	0
	C	N/A	N/A	N/A	N/A	0
SEEQ	N	N/A	N/A	N/A	N/A	0
Seiko-Epson	C	N/A	N/A	N/A	N/A	0
SGS-Ates	N	N/A	N/A	N/A	N/A	0
Sharp	C	N/A	N/A	N/A	N/A	0
Signetics	C	N/A	N/A	N/A	N/A	0
Texas Instruments	N	N/A	S	10	20	30
Toshiba	N	N/A	N/A	N/A	N/A	0
VLSI Technology	C	N/A	N/A	N/A	N/A	0
WaferScale	N	N/A	N/A	N/A	N/A	0
	N	0	0	15	25	40
	C	0	0	0	0	0
Total		0	0	15	25	40
Percentage Change from Previous Quarter						
		0	0	0	67%	
Cumulative Total						
		0	0	15	40	
ASPs:	NMOS	0	0	0	0	0
	CMOS	0	0	0	0	0
Overall		\$200.00	\$100.00	\$80.00	\$70.00	\$73.75
Revenue (\$M)		0	0	1.2	1.8	3.0
Market Share						
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Year
U.S.		0	0	100.0%	100.0%	100.0%
Japan		0	0	0	0	0
Europe		0	0	0	0	0
Total		0	0	100.0%	100.0%	100.0%

S = Sampling
N/A = Not Available

(Continued)

MOS EPROM--Data

Table 4 (Continued)

64K MOS EPROM Shipment Data, 1980-1987

Company	MOS Process	1981				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	N/A	N/A	N/A	N/A	0
Fujitsu	N	S	1	15	100	116
	C	N/A	N/A	N/A	N/A	0
Hitachi	N	S	2	5	25	32
	C	N/A	N/A	N/A	N/A	0
Intel	N	10	70	200	500	780
	N	N/A	N/A	N/A	N/A	0
Mitsubishi	N	N/A	N/A	N/A	S	0
Mostek	N	S	2	5	3	10
Motorola	N	15	40	30	50	135
NEC	N	N/A	N/A	N/A	S	0
	C	N/A	N/A	N/A	N/A	0
Oki Electric	N	N/A	N/A	N/A	N/A	0
Ricoh	C	N/A	N/A	N/A	N/A	0
Rockwell	N	N/A	N/A	N/A	N/A	0
	C	N/A	N/A	N/A	N/A	0
SEEQ	N	N/A	N/A	N/A	N/A	0
Seiko-Epson	C	N/A	N/A	N/A	N/A	0
SGS-Ates	N	N/A	N/A	N/A	N/A	0
Sharp	C	N/A	N/A	N/A	N/A	0
Signetics	C	N/A	N/A	N/A	N/A	0
Texas Instruments	N	30	65	100	100	295
Toshiba	N	N/A	N/A	N/A	N/A	0
VLSI Technology	C	N/A	N/A	N/A	N/A	0
WaferScale	N	N/A	N/A	N/A	N/A	0
	N	55	180	355	778	1,368
	C	0	0	0	0	0
Total		55	180	355	778	1,368
Percentage Change from Previous Quarter						
		120%	227%	97%	119%	
Cumulative Total						
		95	275	630	1,408	
ASPs: NMOS						
		0	0	0	0	0
CMOS						
		0	0	0	0	0
Overall						
		\$70.00	\$60.00	\$38.00	\$24.00	\$34.22
Revenue (\$M)						
		3.9	10.8	13.5	18.7	46.8
Market Share						
U.S.		100.0%	98.3%	94.4%	83.9%	89.2%
Japan		0	1.7	5.6	16.1	10.8
Europe		0	0	0	0	0
Total		100.0%	100.0%	100.0%	100.0%	100.0%

S = Sampling
N/A = Not Available

(Continued)

MOS EPROM--Data

Table 4 (Continued)

64K MOS EPROM Shipment Data, 1980-1987

Company	MOS Process	1982				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	S	10	250	500	760
Fujitsu	N	400	1,000	1,500	2,000	4,900
	C	10	25	50	100	185
Hitachi	N	100	250	600	800	1,750
	C	N/A	N/A	N/A	N/A	0
Intel	N	800	1,700	2,500	2,500	7,500
	N	N/A	N/A	N/A	N/A	0
Mitsubishi	N	S	15	500	1,400	1,915
Mostek	N	0	0	0	0	0
Motorola	N	60	100	100	100	360
NEC	N	S	10	60	200	270
	C	N/A	N/A	N/A	N/A	0
Oki Electric	N	N/A	N/A	N/A	S	0
Ricoh	C	N/A	N/A	N/A	N/A	0
Rockwell	N	N/A	N/A	N/A	N/A	0
	C	N/A	N/A	N/A	N/A	0
SEEQ	N	N/A	S	5	15	20
Seiko-Epson	C	N/A	N/A	N/A	N/A	0
SGS-Ates	N	N/A	N/A	N/A	N/A	0
Sharp	C	N/A	N/A	N/A	N/A	0
Signetics	C	N/A	N/A	N/A	N/A	0
Texas Instruments	N	100	100	100	100	400
Toshiba	N	N/A	S	20	50	70
VLSI Technology	C	N/A	N/A	N/A	N/A	0
WaferScale	N	N/A	N/A	N/A	N/A	0
	N	1,460	3,185	5,635	7,665	17,945
	C	10	25	50	100	185
Total		1,470	3,210	5,685	7,765	18,130
Percentage Change from Previous Quarter						
		89%	118%	77%	37%	
Cumulative Total		2,878	6,088	11,773	19,538	
ASPs: NMOS		0	0	0	0	0
CMOS		0	0	0	0	0
Overall		\$15.00	\$11.50	\$8.50	\$6.50	\$8.70
Revenue (\$M)		22.1	36.9	48.3	50.5	157.8
Market Share						
U.S.		65.3%	59.5%	52.0%	41.4%	49.9%
Japan		34.7	40.5	48.0	58.6	50.1
Europe		0	0	0	0	0
Total		100.0%	100.0%	100.0%	100.0%	100.0%

S = Sampling
N/A = Not Available

(Continued)

MOS EPROM--Data

Table 4 (Continued)

64K MOS EPROM Shipment Data, 1980-1987

Company	MOS Process	1983				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	600	900	1,300	1,800	4,600
Fujitsu	N	2,200	2,400	2,500	3,000	10,100
	C	250	300	350	400	1,300
Hitachi	N	1,500	2,300	3,500	5,500	12,800
	C	N/A	S	50	50	100
Intel	N	3,000	3,500	4,000	3,500	14,000
	N	N/A	N/A	N/A	N/A	0
Mitsubishi	N	1,700	2,000	3,200	3,800	10,700
Mostek	N	0	0	0	0	0
Motorola	N	150	200	450	700	1,500
NEC	N	350	500	500	600	1,950
	C	N/A	N/A	N/A	N/A	0
Oki Electric	N	25	50	100	200	375
Ricoh	C	N/A	N/A	N/A	N/A	0
Rockwell	N	N/A	N/A	N/A	N/A	0
	C	N/A	N/A	N/A	N/A	0
SEEQ	N	25	100	310	600	1,035
Seiko-Epson	C	N/A	N/A	N/A	N/A	0
SGS-Ates	N	N/A	N/A	N/A	S	0
Sharp	C	N/A	N/A	N/A	N/A	0
Signetics	C	N/A	N/A	S	S	0
Texas Instruments	N	400	800	1,500	2,000	4,700
Toshiba	N	200	400	400	600	1,600
VLSI Technology	C	N/A	N/A	N/A	N/A	0
WaferScale	N	N/A	N/A	N/A	N/A	0
	N	10,150	13,150	17,760	22,300	63,360
	C	250	300	400	450	1,400
Total		10,400	13,450	18,160	22,750	64,760
Percentage Change from Previous Quarter						
		34%	29%	35%	25%	
Cumulative Total		29,938	43,388	61,548	84,298	
ASPs:	NMOS	0	0	0	0	0
	CMOS	0	0	0	0	0
	Overall	\$5.50	\$4.75	\$5.00	\$5.50	\$5.20
Revenue (\$M)		57.2	63.9	90.8	125.1	337.0
Market Share						
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Year
U.S.		40.1%	40.9%	41.6%	37.8%	39.9%
Japan		59.9	59.1	58.4	62.2	60.1
Europe		0	0	0	0	0
Total		100.0%	100.0%	100.0%	100.0%	100.0%

S = Sampling
N/A = Not Available

(Continued)

MOS EPROM--Data

Table 4 (Continued)

64K MOS EPROM Shipment Data, 1980-1987

		1984				
Company	MOS Process	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Year
AMD	N	1,200	1,300	1,600	1,700	5,800
Fujitsu	N	2,500	2,800	3,000	3,000	11,300
	C	500	600	700	900	2,700
Hitachi	N	4,000	5,000	6,000	6,000	21,000
	C	100	250	300	350	1,000
Intel	N	2,000	2,000	2,000	2,000	8,000
	N	N/A	N/A	N/A	S	0
Mitsubishi	N	5,000	5,700	5,700	5,000	21,400
Mostek	N	0	0	0	0	0
Motorola	N	900	900	600	500	2,900
NEC	N	800	1,400	900	1,200	4,300
	C	N/A	N/A	N/A	S	0
Oki Electric	N	400	600	500	400	1,900
Ricoh	C	N/A	0	25	100	125
Rockwell	N	S	10	0	0	10
	C	10	50	0	0	60
SEEQ	N	800	1,000	1,050	1,100	3,950
Seiko-Epson	C	N/A	N/A	N/A	N/A	0
SGS	N	50	150	350	600	1,150
Sharp	C	N/A	N/A	N/A	N/A	0
Signetics	C	S	10	10	10	30
Texas Instruments	N	2,400	2,600	2,800	2,400	10,200
Toshiba	N	400	1,200	800	500	2,900
VLSI Technology	C	N/A	N/A	N/A	N/A	0
WaferScale	N	N/A	N/A	N/A	N/A	0
	N	20,450	24,660	25,300	24,400	94,810
	C	610	910	1,035	1,360	3,915
Total		21,060	25,570	26,335	25,760	98,725
Percentage Change from Previous Quarter		(7%)	21%	3%	(2%)	
Cumulative Total		105,358	130,928	157,263	183,023	
ASPs:	NMOS	\$5.25	\$5.25	\$4.75	\$4.25	\$4.86
	CMOS	\$15.00	\$15.00	\$13.50	\$10.00	\$12.87
	Overall	\$5.53	\$5.60	\$5.09	\$4.55	\$5.18
Revenue (\$M)		116.5	143.1	134.1	117.3	511.1
		1984				
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Year
Market Share						
U.S.		34.7%	30.8%	30.6%	29.9%	31.3%
Japan		65.1	68.6	68.1	67.7	67.5
Europe		0.2	0.6	1.3	2.3	1.2
Total		100.0%	100.0%	100.0%	100.0%	100.0%

S = Sampling

N/A = Not Available

Note: Columns may not add to totals shown because of rounding.

(Continued)

MOS EPROM--Data

Table 4 (Continued)

64K MOS EPROM Shipment Data, 1980-1987

Company	MOS Process	1985				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	2,100	1,550	1,825	1,150	6,625
Fujitsu	N	3,500	3,500	3,800	3,500	14,300
	C	800	950	1,000	1,200	3,950
Hitachi	N	5,500	5,200	5,000	4,500	20,200
	C	400	400	450	500	1,750
Intel	N	2,600	3,000	3,000	2,900	11,500
	N	25	75	150	250	500
Mitsubishi	N	4,850	2,600	4,300	4,200	15,950
Mostek	N	0	0	0	0	0
Motorola	N	400	300	300	400	1,400
NEC	N	1,250	1,450	1,650	1,800	6,150
	C	40	200	350	300	890
Oki Electric	N	350	300	200	150	1,000
Ricoh	C	200	250	250	150	850
Rockwell	N	0	0	0	0	0
	C	0	0	0	0	0
SEEQ	N	625	500	350	275	1,750
Seiko-Epson	C	N/A	N/A	N/A	S	0
SGS	N	880	850	1,000	1,350	4,080
Sharp	C	N/A	N/A	N/A	S	0
Signetics	C	0	0	0	0	0
Texas Instruments	N	2,200	2,000	2,000	2,000	8,200
Toshiba	N	800	600	500	350	2,250
VLSI Technology	C	N/A	S	20	40	60
WaferScale	N	N/A	N/A	S	10	10
	N	25,080	21,925	24,075	22,825	93,905
	C	1,440	1,800	2,070	2,200	7,510
Total		26,520	23,725	26,145	25,025	101,415

Percentage Change from
Previous Quarter

3% (11%) 10% (4%)

Cumulative Total

209,543 233,268 259,413 284,438

ASPs:

NMOS

\$3.60

\$2.80

\$2.35

\$2.10

\$2.73

CMOS

\$6.00

\$4.55

\$3.75

\$3.25

\$4.23

Overall

\$3.63

\$2.93

\$2.46

\$2.20

\$2.84

Revenue (\$M)

98.9

69.6

64.3

55.1

287.9

	1985				Year
	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
Market Share					
U.S.	30.0%	31.3%	29.2%	28.1%	29.6%
Japan	66.7	65.1	66.9	66.5	66.4
Europe	3.3	3.6	3.8	5.4	4.0
Total	100.0%	100.0%	100.0%	100.0%	100.0%

S = Sampling

N/A = Not Available

Note: Columns may not add to totals shown because of rounding.

(Continued)

MOS EPROM--Data

Table 4 (Continued)

64K MOS EPROM Shipment Data, 1980-1987

Company	MOS Process	1986				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	850	800	900	1,385	3,935
Fujitsu	N	1,500	1,500	2,000	4,000	9,000
	C	1,000	1,000	2,000	4,000	8,000
General Instruments	C	S	0	31	170	201
	OTP	N/A	N/A	S	10	10
Gold Star	C	S	S	0	5	5
Hitachi	N	5,400	5,000	4,500	4,000	18,900
	C	700	700	700	700	2,800
Hyundai	C	S	S	0	5	5
Intel	N	3,400	3,300	2,400	3,200	12,300
	C	250	500	425	400	1,575
	N OTP	400	400	300	200	1,300
	C OTP	0	30	130	100	260
Mitsubishi	N	3,226	3,339	3,459	2,810	12,834
	OTP	775	43	564	511	1,893
Motorola	N	147	346	177	114	784
	OTP	66	87	54	22	229
National Semi.	C	25	75	150	200	450
NEC	N	1,850	1,000	300	150	3,300
	C	800	1,000	490	300	2,590
	OTP	240	140	100	50	530
Ricoh	C	0	0	25	50	75
SEEQ	N	525	615	315	150	1,605
Seiko-Epson	C	0	75	100	150	325
SGS	N	552	608	2,500	2,500	6,160
Sharp	C	0	5	10	15	30
	OTP	S	8	0	0	0
Signetics	C	0	5	5	10	20
Texas Instruments	N	1,400	1,400	1,800	1,600	6,200
Toshiba	N	500	600	600	900	2,600
	OTP	100	400	500	500	1,500
VLSI Technology	C	40	40	40	50	170
WaferScale	C	0	10	10	10	30
Others	C	0	0	5	5	10
	N	20,691	19,438	20,369	22,042	82,540
	C	3,055	3,580	4,221	6,230	17,086
Total		23,746	23,018	24,590	28,272	99,626
Percentage Change from Previous Quarter		(5%)	(3%)	7%	15%	
Cumulative Total		308,184	331,202	355,792	384,064	
ASPs:	NMOS	\$2.15	\$2.35	\$2.60	\$2.75	\$2.47
	CMOS	\$3.50	\$3.75	\$3.85	\$4.10	\$3.86
	Overall	\$2.32	\$2.57	\$2.81	\$3.05	\$2.71
Revenue (\$M)		55.2	59.1	69.2	86.2	269.7
		1986				
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Year
Market Share						
U.S.		29.9%	33.1%	27.4%	27.0%	29.2%
Japan		67.8	64.3	62.4	64.1	64.6
Europe		2.3	2.6	10.2	8.8	6.2
ROW		0	0	0	0	0
Total		100.0%	100.0%	100.0%	100.0%	100.0%

S = Sampling

N/A = Not Available

Note: Columns may not add to totals shown because of rounding.

(Continued)

MOS EPROM--Data

Table 4 (Continued)

64K MOS EPROM Shipment Data, 1980-1987

<u>Company</u>	<u>MOS Process</u>	<u>1987</u>				<u>Year</u>
		<u>1st Qtr.</u>	<u>2nd Qtr.</u>	<u>3rd Qtr.</u>	<u>4th Qtr.</u>	
AMD	N	1,300	1,500	1,170	1,600	5,570
Cypress	C	50	75	100	100	325
Fujitsu	N	400	1,000	1,000	1,000	3,400
	C	1,800	2,000	2,200	2,200	8,200
Gold Star	C	5	5	5	5	20
Hitachi	N	2,500	1,500	1,000	0	5,000
	C	700	700	400	0	1,800
	C OTP	0	50	100	0	150
Hyundai	C	5	5	10	20	40
Intel	N	1,400	1,400	1,100	1,700	5,600
	C	400	400	500	400	1,700
	N OTP	350	300	150	250	1,050
	C OTP	200	250	200	200	850
Microchip Tech., Inc.	C	100	299	202	632	1,233
	OTP	10	20	50	100	180
Mitsubishi	N	1,450	1,150	1,250	1,600	5,450
	OTP	450	250	200	300	1,200
Motorola	N	125	100	86	60	371
	OTP	17	10	13	6	46
National Semi.	C	606	1,198	1,580	2,341	5,725
	C OTP	N/A	N/A	N/A	8	0
NEC	N	400	60	70	0	530
	C	1,000	370	390	200	1,960
	OTP	0	0	0	0	0
Oki Electric	N	50	50	50	50	200
	N OTP	450	450	400	350	1,650
Ricoh	C	50	50	100	100	300
SEEQ	N	200	200	200	200	800
Seiko-Epson	C	100	100	100	100	400
SGS-Thomson	N	870	1,645	2,080	2,100	6,695
	C	80	110	40	100	330
	C OTP	5	45	70	100	220
Sharp	C	0	80	150	250	480
	OTP	0	0	0	0	0
Signetics	C	200	450	800	1,100	2,550
Texas Instruments	N	1,100	1,200	1,350	1,400	5,050
Toshiba	N	700	500	500	200	1,900
	N OTP	1,000	1,000	1,000	1,000	4,000
VLSI Technology	C	75	100	100	100	375
WaferScale	C	30	50	50	50	180
	N	12,762	12,315	11,619	11,816	48,512
	C	5,416	6,407	7,247	8,098	27,168
Total		18,178	18,722	18,866	19,914	75,680

(Continued)

MOS EPROM--Data

Table 4 (Continued)

64K MOS EPROM Shipment Data, 1980-1987

	1987				Year
	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
Percentage Change from Previous Quarter	(36%)	(3%)	1%	6%	
Cumulative Total	402,242	420,964	439,630	459,744	
ASPs: NMOS	\$2.80	\$2.90	\$3.00	\$3.10	\$2.95
CMOS	\$3.00	\$3.10	\$3.00	\$3.20	\$3.08
Overall	\$2.86	\$2.97	\$3.00	\$3.14	\$3.00
Revenue (\$M)	52.0	55.6	56.6	62.5	226.7
	1987				Year
	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
Market Share					
U.S.	32.8%	37.9%	36.3%	45.9%	38.4%
Japan	60.8	49.7	47.2	36.9	48.4
Europe	6.4	12.0	15.8	17.0	12.9
ROW	0.1	0.3	0.6	0.1	0.3
Total	100.0%	100.0%	100.0%	100.0%	100.0%

S = Sampling

N/A = Not Available

Note: Columns may not add to totals shown because of rounding.

Source: Dataquest
May 1989

MOS EPROM--Data

Table 5

128K MOS EPROM Shipment Data, 1982-1987

Company	MOS Process	1982				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	N/A	N/A	N/A	S	0
Fujitsu	N	N/A	N/A	N/A	S	0
	C	N/A	N/A	N/A	N/A	0
Hitachi	N	N/A	N/A	N/A	S	0
Intel	N	3	15	50	150	218
Mitsubishi	N	N/A	N/A	N/A	N/A	0
	C	N/A	N/A	N/A	N/A	0
NEC	N	N/A	N/A	N/A	N/A	0
SEEQ	N	N/A	N/A	N/A	S	0
Texas Instruments	N	N/A	S	5	5	10
	C	N/A	N/A	N/A	N/A	0
Toshiba	N	N/A	N/A	N/A	N/A	N/A
	N	3	15	55	155	228
	C	0	0	0	0	0
Total		3	15	55	155	228
Percentage Change from Previous Quarter						
		0	400%	267%	182%	
Cumulative Total						
		3	18	73	228	
Average Selling Price						
		\$75.00	\$60.00	\$50.00	\$40.00	\$44.19
Revenue (\$M)						
		0.2	0.9	2.8	6.2	10.1
Market Share						
		100.0%	100.0%	100.0%	100.0%	100.0%
U.S.		0	0	0	0	0
Japan		0	0	0	0	0
Europe		0	0	0	0	0
Total		100.0%	100.0%	100.0%	100.0%	100.0%

S = Sampling
N/A = Not Available

(Continued)

MOS EPROM--Data

Table 5 (Continued)

128K MOS EPROM Shipment Data, 1982-1987

Company	MOS Process	1983				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	50	175	300	500	1,025
Fujitsu	N	10	50	150	350	560
	C	S	10	25	35	70
Hitachi	N	10	50	150	350	560
Intel	N	450	800	1,200	1,500	3,950
Mitsubishi	N	S	10	10	10	30
	C	N/A	N/A	N/A	N/A	0
NEC	N	S	10	20	100	130
SEEQ	N	N/A	S	50	100	150
Texas Instruments	N	0	0	0	0	0
	C	N/A	N/A	N/A	N/A	0
Toshiba	N	S	10	20	50	80
	N	520	1,105	1,900	2,960	6,485
	C	0	10	25	35	70
Total		520	1,115	1,925	2,995	6,555
Percentage Change from Previous Quarter						
		235%	114%	73%	56%	
Cumulative Total						
		748	1,863	3,788	6,783	
Average Selling Price						
		\$30.00	\$22.00	\$17.00	\$16.00	\$18.44
Revenue (\$M)						
		15.6	24.5	32.7	47.9	120.8
Market Share						
		96.2%	87.4%	80.5%	70.1%	78.2%
U.S.		3.8	12.6	19.5	29.9	21.8
Japan		0	0	0	0	0
Europe		0	0	0	0	0
Total		100.0%	100.0%	100.0%	100.0%	100.0%

S = Sampling
N/A = Not Available

(Continued)

MOS EPROM--Data

Table 5 (Continued)

128K MOS EPROM Shipment Data, 1982-1987

Company	MOS Process	1984				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	500	800	850	900	3,050
Fujitsu	N	550	750	800	700	2,800
	C	50	75	100	100	325
Hitachi	N	650	1,800	2,000	2,800	7,250
Intel	N	1,500	1,600	1,700	2,200	7,000
Mitsubishi	N	60	400	1,500	2,200	4,160
	C	N/A	N/A	N/A	S	0
NEC	N	20	160	600	1,000	1,780
SEEQ	N	150	400	525	575	1,650
Texas Instruments	N	10	25	25	25	85
	C	N/A	N/A	N/A	N/A	0
Toshiba	N	100	300	500	900	1,800
	N	3,540	6,235	8,500	11,300	29,575
	C	50	75	100	100	325
Total		3,590	6,310	8,600	11,400	29,900
Percentage Change from Previous Quarter						
		20%	76%	36%	33%	
Cumulative Total		10,373	16,683	25,283	36,683	
ASPs:	NMOS	\$15.25	\$14.00	\$12.25	\$10.00	\$12.12
	CMOS	\$28.00	\$25.00	\$20.00	\$18.00	\$21.77
	Overall	\$15.43	\$14.13	\$12.34	\$10.07	\$12.22
Revenue (\$M)		55.4	89.2	106.1	114.8	365.5
Market Share						
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Year
U.S.		60.2%	44.8%	36.0%	32.5%	39.4%
Japan		39.8	55.2	64.0	67.5	60.6
Europe		0	0	0	0	0
Total		100.0%	100.0%	100.0%	100.0%	100.0%

S = Sampling
N/A = Not Available

(Continued)

MOS EPROM--Data

Table 5 (Continued)
128K MOS EPROM Shipment Data, 1982-1987

Company	MOS Process	1985				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	1,150	950	850	900	3,850
Fujitsu	N	1,000	1,500	1,750	2,000	6,250
	C	100	100	100	100	400
Hitachi	N	3,000	3,200	3,500	3,100	12,800
Intel	N	2,000	1,800	2,000	2,200	8,000
Mitsubishi	N	1,800	2,000	2,700	3,000	9,500
	C	5	10	10	100	125
NEC	N	1,500	2,000	1,750	3,200	8,450
SEEQ	N	375	300	250	225	1,150
Texas Instruments	N	50	25	0	0	75
	C	N/A	N/A	5	25	25
Toshiba	N	1,000	1,200	1,500	1,500	5,200
	N	11,875	12,975	14,300	16,125	55,275
	C	105	110	110	225	550
Total		11,980	13,085	14,410	16,350	55,825
Percentage Change from Previous Quarter		5%	9%	10%	13%	
Cumulative Total		48,663	61,748	76,158	92,508	
ASPs: NMOS		\$6.50	\$4.10	\$3.10	\$2.60	\$3.92
CMOS		\$15.00	\$9.00	\$5.00	\$3.75	\$7.20
Overall		\$6.57	\$4.14	\$3.11	\$2.62	\$3.95
Revenue (\$M)		78.8	54.2	44.9	42.8	220.6
		1985				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
Market Share						
U.S.		29.8%	23.5%	21.5%	20.5%	23.5%
Japan		70.2	76.5	78.5	79.5	76.5
Europe		0	0	0	0	0
Total		100.0%	100.0%	100.0%	100.0%	100.0%

S = Sampling
N/A = Not Available

(Continued)

MOS EPROM--Data

Table 5 (Continued)

128K MOS EPROM Shipment Data, 1982-1987

Company	MOS Process	1986				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	1,300	1,100	1,050	1,715	5,165
Fujitsu	N	800	800	800	800	3,200
	C	100	100	100	100	400
General Instrument	C	N/A	S	20	150	170
	OTP	N/A	N/A	S	10	10
Hitachi	N	3,200	3,000	2,500	2,500	11,200
Intel	N	2,200	2,600	2,800	2,900	10,500
	OTP	200	500	650	400	1,750
Mitsubishi	N	2,300	1,850	1,800	1,700	7,650
	C	75	70	90	120	355
	N OTP	650	650	550	300	2,150
	C OTP	0	0	0	0	0
NEC	N	3,110	3,000	1,520	1,000	8,630
SEEQ	N	325	325	300	225	1,175
Seiko-Epson	N	0	10	15	25	50
Texas Instruments	N	N/A	N/A	N/A	N/A	0
	C	100	175	225	400	900
Toshiba	N	700	700	700	600	2,700
	OTP	50	200	400	600	1,250
VLSI Technology	C	5	10	10	10	35
WaferScale	C	S	0	5	5	10
Others	C	N/A	S	5	10	15
	N	14,835	14,735	13,085	12,780	55,435
	C	280	355	455	805	1,895
Total		15,115	15,090	13,540	13,585	57,330
Percentage Change from Previous Quarter						
		(8%)	0	(10%)	0	
Cumulative Total		107,623	122,713	136,253	149,838	
ASPs:						
	NMOS	\$2.55	\$2.65	\$2.75	\$2.75	\$ 2.67
	CMOS	\$3.70	\$3.90	\$4.00	\$4.00	\$ 3.94
	Overall	\$2.57	\$2.68	\$2.79	\$2.82	\$ 2.71
Revenue (\$M)		38.9	40.4	37.8	38.4	155.5
Market Share						
	U.S.	27.3%	31.2%	37.4%	42.9%	34.4%
	Japan	72.7	68.8	62.6	57.0	65.6
	Europe	0.0	0.0	0.0	0.1	0.0
Total		100.0%	100.0%	100.0%	100.0%	100.0%

S = Sampling
N/A = Not Applicable

(Continued)

MOS EPROM--Data

Table 5 (Continued)

128K MOS EPROM Shipment Data, 1982-1987

Company	MOS Process	1987				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	1,300	1,925	1,725	1,900	6,850
Fujitsu	N	1,000	1,200	1,100	1,100	4,400
	C	600	800	900	900	3,200
Hitachi	N	2,000	2,000	1,800	0	5,800
Intel	N	2,200	2,250	1,000	2,250	7,700
	N OTP	800	600	420	140	1,960
	C	0	100	250	300	650
	C OTP	0	0	20	20	40
Microchip Tech., Inc.	C	141	227	420	741	1,529
	C OTP	20	45	80	228	373
Mitsubishi	N	1,150	1,300	1,400	950	4,800
	C	40	100	130	60	330
	N OTP	120	250	300	100	770
	C OTP	0	0	0	0	0
National Semi.	C	222	191	223	390	1,026
NEC	N	900	590	430	330	2,250
Oki Electric	N	100	150	100	100	450
	N OTP	0	0	0	0	0
SEEQ	N	150	150	100	100	500
Seiko-Epson	N	0	10	15	25	50
SGS-Thomson	N	180	525	1,160	1,700	3,565
Texas Instruments	N	0	25	25	70	120
	C	800	950	1,100	1,200	4,050
Toshiba	N	500	500	1,000	1,000	3,000
	N OTP	900	1,000	1,000	1,200	4,100
VLSI Technology	C	5	10	10	10	35
WaferScale	C	5	0	5	5	10
	N	11,300	12,475	11,575	10,965	46,315
	C	1,828	2,423	3,138	3,854	11,243
Total		13,128	14,898	14,713	14,819	57,558
Percentage Change from Previous Quarter		(3%)	13%	(1%)	1%	
Cumulative Total		162,966	177,864	192,577	207,396	
ASPs: NMOS		\$3.00	\$3.35	\$3.45	\$3.75	\$ 3.38
CMOS		\$3.90	\$3.80	\$3.90	\$4.25	\$ 4.00
Overall		\$3.13	\$3.42	\$3.54	\$3.88	\$ 3.50
Revenue (\$M)		41.0	51.0	52.2	57.5	201.7

	1987				Year
	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
Market Share					
U.S.	42.9%	43.4%	36.6%	49.6%	43.2%
Japan	55.7	53.0	55.6	38.9	50.6
Europe	1.4	3.5	7.9	11.5	6.2
Total	100.0%	100.0%	100.0%	100.0%	100.0%

S = Sampling

N/A = Not Applicable

Note: Columns may not add to totals shown because of rounding.

Source: Dataquest
May 1989

MOS EPROM--Data

Table 6

256K MOS EPROM Shipment Data, 1983-1987

Company	MOS Process	1983				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	N/A	S	10	25	35
Atmel	N	N/A	N/A	N/A	N/A	0
	C	N/A	N/A	N/A	N/A	0
Fujitsu	N	N/A	N/A	N/A	N/A	0
	C	S	S	5	20	25
General Instrument	N	N/A	N/A	N/A	N/A	0
	C	N/A	N/A	N/A	N/A	0
Hitachi	N	N/A	N/A	N/A	N/A	0
	C	N/A	N/A	N/A	N/A	0
Intel	N	5	10	35	90	140
	C	N/A	N/A	N/A	N/A	0
Mitsubishi	N	N/A	N/A	N/A	S	0
National Semi.	C	N/A	N/A	N/A	N/A	0
NEC	N	N/A	N/A	N/A	S	0
	C	N/A	N/A	N/A	N/A	0
SEEQ	C	N/A	N/A	N/A	N/A	0
Seiko-Epson	C	N/A	N/A	N/A	N/A	0
SGS-Ates	N	N/A	N/A	N/A	N/A	0
Texas Instruments	C	N/A	N/A	N/A	N/A	0
Toshiba	N	N/A	N/A	N/A	N/A	0
	C	N/A	N/A	N/A	N/A	0
VLSI Technology	C	N/A	N/A	N/A	N/A	0
WaferScale	C	N/A	N/A	N/A	N/A	0
	N	5	10	45	115	175
	C	0	0	5	20	25
Total		5	10	50	135	200
Percentage Change from Previous Quarter		0	100%	400%	170%	
Cumulative Total		5	15	65	200	
ASPs: NMOS		\$150	\$125	\$100	\$95	\$100
CMOS		0	0	\$145	\$115	\$121
Overall		\$150	\$125	\$105	\$98	\$102
Revenue (\$M)		0.8	1.3	5.2	13.2	20.5
		1983				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
Market Share						
U.S.		100.0%	100.0%	90.0%	85.2%	87.5%
Japan		0	0	10.0	14.8	12.5
Europe		0	0	0	0	0
Total		100.0%	100.0%	100.0%	100.0%	100.0%

S = Sampling
N/A = Not Available

(Continued)

MOS EPROM--Data

Table 6 (Continued)

256K MOS EPROM Shipment Data, 1983-1987

Company	MOS Process	1984				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	100	130	100	250	580
Atmel	N	N/A	N/A	N/A	N/A	0
	C	N/A	N/A	N/A	N/A	0
Fujitsu	N	N/A	N/A	N/A	10	10
	C	30	40	50	75	195
General Instrument	N	N/A	N/A	N/A	N/A	0
	C	N/A	N/A	N/A	N/A	0
Hitachi	N	N/A	N/A	S	S	0
	C	N/A	N/A	S	S	0
Intel	N	150	250	375	475	1,250
	C	N/A	N/A	N/A	N/A	0
Mitsubishi	N	S	S	S	S	5
National Semi.	C	N/A	N/A	N/A	N/A	0
NEC	N	S	S	S	S	5
	C	N/A	N/A	N/A	N/A	0
SEEQ	C	N/A	S	S	S	5
Seiko-Epson	C	N/A	N/A	N/A	N/A	0
SGS	N	N/A	N/A	N/A	N/A	0
Texas Instruments	C	N/A	N/A	N/A	N/A	0
Toshiba	N	10	30	50	100	190
	C	N/A	N/A	S	S	0
VLSI Technology	C	N/A	N/A	N/A	N/A	0
WaferScale	C	N/A	—	—	—	0
	N	260	410	525	845	2,040
	C	30	40	50	80	200
Total		290	450	575	925	2,240
Percentage Change from Previous Quarter						
		115%	55%	28%	61%	
Cumulative Total						
		490	940	1,515	2,440	
ASPs: NMOS						
		\$75.00	\$45.00	\$35.00	\$28.00	\$39.21
CMOS						
		\$100.00	\$80.00	\$60.00	\$45.00	\$64.00
Overall						
		\$77.59	\$48.11	\$37.17	\$29.47	\$41.42
Revenue (\$M)						
		22.5	21.7	21.4	27.3	92.8
Market Share						
U.S.		86.2%	84.4%	82.6%	78.9%	81.9%
Japan		13.8	15.6	17.4	21.1	18.1
Europe		0	0	0	0	0
Total		100.0%	100.0%	100.0%	100.0%	100.0%

S = Sampling
N/A = Not Available

(Continued)

MOS EPROM--Data

Table 6 (Continued)

256K MOS EPROM Shipment Data, 1983-1987

Company	MOS Process	1985				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	450	800	950	950	3,150
Atmel	N	N/A	N/A	N/A	S	0
	C	N/A	N/A	N/A	S	0
Fujitsu	N	25	200	400	650	1,275
	C	150	250	400	600	1,400
General Instrument	N	N/A	N/A	S	25	25
	C	N/A	N/A	S	10	10
Hitachi	N	50	200	500	800	1,550
	C	S	25	150	300	475
Intel	N	1,000	1,800	2,400	2,700	7,900
	C	N/A	S	50	100	150
Mitsubishi	N	5	25	70	600	700
National Semi.	C	S	S	S	10	10
NEC	N	30	230	550	750	1,560
	C	S	50	150	200	400
SEEQ	C	15	110	180	250	555
Seiko-Epson	C	N/A	N/A	N/A	S	0
SGS	N	N/A	N/A	S	10	10
Texas Instruments	C	N/A	N/A	S	50	50
Toshiba	N	150	350	550	700	1,750
	C	150	200	300	425	1,075
VLSI Technology	C	N/A	S	25	50	75
WaferScale	C	N/A	N/A	S	S	0
	N	1,710	3,605	5,420	7,185	17,920
	C	315	635	1,255	1,995	4,200
Total		2,025	4,240	6,675	9,180	22,120
Percentage Change from Previous Quarter		350%	109%	57%	38%	
Cumulative Total		4,465	8,705	15,380	24,560	
ASPs: NMOS		\$20.00	\$12.00	\$5.30	\$4.25	\$7.63
CMOS		\$30.00	\$13.50	\$7.00	\$6.00	\$9.23
Overall		\$21.56	\$12.22	\$5.62	\$4.63	\$7.93
Revenue (\$M)		43.7	51.8	37.5	42.5	175.5
Market Share		1985				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
U.S.		72.3%	63.9%	54.0%	45.2%	53.9%
Japan		27.7	36.1	46.0	54.7	46.0
Europe		0	0	0	0.1	0
Total		100.0%	100.0%	100.0%	100.0%	100.0%

S = Sampling

N/A = Not Available

Note: Columns may not add to totals shown because of rounding.

(Continued)

MOS EPROM--Data

Table 6 (Continued)

256K MOS EPROM Shipment Data, 1983-1987

Company	MOS Process	1986				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	700	1,000	1,050	1,000	3,750
Atmel	N	0	0	0	0	0
	C	0	0	0	0	0
Fujitsu	N	500	500	500	600	2,100
	C	200	250	250	400	1,100
General Instrument	N	908	600	545	500	2,553
	C	112	317	493	500	1,422
	C OTP	35	85	10	200	330
Hitachi	N	950	1,100	1,350	1,500	4,900
	C	350	500	650	800	2,300
	C OTP	0	0	0	0	0
Intel	N	3,300	4,000	4,200	4,000	15,500
	C	150	175	450	550	1,325
	N OTP	200	250	280	300	1,030
Mitsubishi	N	1,637	2,096	1,776	935	6,444
	C	0	0	19	157	176
	N OTP	1,249	1,480	1,435	3,435	7,599
	C OTP	0	0	0	0	0
National Semi.	C	25	100	250	300	675
NEC	N	1,230	1,250	990	500	3,970
	C	1,620	1,220	1,140	800	4,780
Ok! Electric	N	N/A	S	0	30	30
Ricoh	C	0	0	5	5	10
SEEQ	C	70	70	40	40	220
Seiko-Epson	C	0	5	10	10	25
SGS	N	6	136	10	10	162
Signetics	C	S	S	5	15	20
Texas Instrument	C	125	200	225	800	1,350
Toshiba	N	600	800	800	800	3,000
	C	300	400	400	400	1,500
	N OTP	300	500	800	1,200	2,800
	C OTP	100	200	200	200	700
VLSI Technology	C	50	50	50	50	200
WaferScale	C	S	S	S	S	15
Others	N	0	0	0	0	0
	C	5	5	5	5	20
	N	11,580	13,712	13,736	14,810	53,838
	C	3,142	3,582	4,207	5,237	16,168
Total		14,722	17,294	17,943	20,047	70,006

(Continued)

MOS EPROM--Data

Table 6 (Continued)

256K MOS EPROM Shipment Data, 1983–1987

	1986				
	1st	2nd	3rd	4th	
	<u>Qtr.</u>	<u>Qtr.</u>	<u>Qtr.</u>	<u>Qtr.</u>	<u>Year</u>
Percentage Change from Previous Quarter	60%	17%	4%	12%	
Cumulative Total	39,282	56,576	74,519	94,566	
ASPs: NMOS	\$4.14	\$4.50	\$4.50	\$4.20	\$4.34
CMOS	\$5.00	\$5.50	\$5.50	\$5.25	\$5.32
Overall	\$4.32	\$4.71	\$4.73	\$4.47	\$4.57
Revenue (\$M)	63.7	81.4	85.0	89.7	319.7

	1986				
	1st	2nd	3rd	4th	
	<u>Qtr.</u>	<u>Qtr.</u>	<u>Qtr.</u>	<u>Qtr.</u>	<u>Year</u>
Market Share					
U.S.	38.6%	39.6%	42.4%	41.2%	40.6%
Japan	61.4	59.6	57.5	58.7	59.2
Europe	<u>0.0</u>	<u>0.8</u>	<u>0.1</u>	<u>0.0</u>	<u>0.2</u>
Total	100.0%	100.0%	100.0%	100.0%	100.0%

S = Sampling

N/A = Not Available

Columns may not add to totals shown because of rounding.

(Continued)

MOS EPROM--Data

Table 6 (Continued)

256K MOS EPROM Shipment Data, 1983-1987

Company	MOS Process	1987				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	1,585	2,850	1,600	1,860	6,895
	C	0	10	100	215	325
Fujitsu	N	900	800	950	900	3,550
	C	700	1,700	2,050	2,500	6,950
Hitachi	N	2,500	2,500	1,600	0	6,600
	C	2,200	2,000	2,000	0	6,200
	C OTP	0	0	0	0	0
Intel	N	4,500	5,400	4,300	4,600	18,800
	C	450	500	370	260	1,580
	N OTP	800	1,200	1,000	950	3,950
	C OTP	100	50	250	170	570
	N	600	700	700	800	2,800
Microchip Tech., Inc.	C	900	1,000	1,000	300	3,200
	OTP	200	200	400	100	900
Mitsubishi	N	1,300	1,800	2,200	1,750	7,050
	C	400	500	750	800	2,450
	N OTP	950	450	800	400	2,600
	C OTP	0	0	20	60	80
National Semi.	C	654	1,257	1,606	3,510	7,027
NEC	N	690	540	360	400	1,990
	C	1,090	870	1,600	1,250	4,810
Oki Electric	N	100	100	100	50	350
	N OTP	800	800	800	800	3,200
Ricoh	C	5	5	10	20	40
SEEQ	C	75	75	75	75	300
Seiko-Epson	C	20	20	20	10	70
SGS-Thomson	N	840	1,160	1,170	1,600	4,770
Signetics	C	200	250	400	500	1,350
Texas Instrument	C	1,300	1,400	1,500	1,700	5,900
Toshiba	N	800	800	1,000	1,500	4,100
	C	500	800	1,200	1,000	3,500
	N OTP	1,400	1,500	1,000	1,000	4,900
	C OTP	200	400	400	400	1,400
VLSI Technology	C	25	30	30	50	135
WaferScale	C	15	20	20	30	85
	N	17,765	19,600	17,580	16,610	71,555
	C	9,034	11,087	13,801	12,950	46,872
Total		26,799	30,687	31,381	29,560	118,427

(Continued)

MOS EPROM--Data

Table 6 (Continued)

256K MOS EPROM Shipment Data, 1983–1987

	1987				
	1st	2nd	3rd	4th	
	<u>Qtr.</u>	<u>Qtr.</u>	<u>Qtr.</u>	<u>Qtr.</u>	<u>Year</u>
Percentage Change from Previous Quarter	34%	15%	2%	(6%)	
Cumulative Total	121,365	152,052	183,433	212,993	
ASPs: NMOS	\$4.25	\$4.35	\$4.40	\$4.45	\$4.36
CMOS	\$4.90	\$5.00	\$5.10	\$5.10	\$5.04
Overall	\$4.47	\$4.59	\$4.71	\$4.73	\$4.63
Revenue (\$M)	119.8	140.7	147.7	140.0	548.2

	1987				
	1st	2nd	3rd	4th	
	<u>Qtr.</u>	<u>Qtr.</u>	<u>Qtr.</u>	<u>Qtr.</u>	<u>Year</u>
Market Share					
U.S.	41.8%	44.6%	41.3%	49.5%	44.3%
Japan	54.3	50.8	53.7	43.4	50.5
Europe	<u>3.9</u>	<u>4.6</u>	<u>5.0</u>	<u>7.1</u>	<u>5.2</u>
Total	100.0%	100.0%	100.0%	100.0%	100.0%

S = Sampling

N/A = Not Available

Columns may not add to totals shown because of rounding.

Source: Dataquest
May 1989

MOS EPROM--Data

Table 7

512K MOS EPROM Shipment Data, 1984-1987

Company	MOS Process	1984				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	S	2	2	4	8
Fujitsu	N	N/A	N/A	N/A	N/A	0
General Instrument	C	N/A	N/A	N/A	N/A	0
Hitachi	N	N/A	N/A	N/A	N/A	0
	C	N/A	N/A	N/A	N/A	0
Intel	N	N/A	S	2	6	8
Mitsubishi	N	N/A	N/A	N/A	N/A	0
Toshiba	N	N/A	N/A	N/A	N/A	0
	C	N/A	N/A	N/A	N/A	0
VLSI Technology	C	N/A	N/A	N/A	N/A	0
WaferScale	C	N/A	N/A	N/A	N/A	0
	N	0	2	4	10	16
	C	0	0	0	0	0
Total		0	2	4	10	16

Percentage Change from
Previous Quarter

0 0 100% 150%

Cumulative Total

0 2 6 16

ASPs: NMOS
CMOS
Overall

\$250.00 \$150.00 \$120.30 \$95.00 \$108.13
0 0 0 0 0
\$250.00 \$150.00 \$120.00 \$95.00 \$108.13

Revenue (\$M)

0 0.3 0.5 1.0 1.7

	1984				Year
	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
Market Share					
U.S.	0	100.0%	100.0%	100.0%	100.0%
Japan	0	0	0	0	0
Europe	0	0	0	0	0
Total	0	100.0%	100.0%	100.0%	100.0%

S = Sampling
N/A = Not Available

(Continued)

MOS EPROM--Data

Table 7 (Continued)

512K MOS EPROM Shipment Data, 1984-1987

Company	MOS Process	1985				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	12	30	35	75	152
Fujitsu	N	N/A	N/A	S	10	10
General Instrument	C	N/A	N/A	N/A	N/A	0
Hitachi	N	N/A	N/A	S	15	15
	C	N/A	N/A	N/A	N/A	0
Intel	N	15	50	65	135	265
Mitsubishi	N	N/A	N/A	N/A	N/A	0
Toshiba	N	N/A	N/A	N/A	S	0
	C	N/A	N/A	N/A	N/A	0
VLSI Technology	C	N/A	N/A	N/A	N/A	0
WaferScale	C	N/A	N/A	N/A	N/A	0
	N	27	80	100	225	432
	C	0	0	0	10	10
Total		27	80	100	235	442
Percentage Change from Previous Quarter		170%	196%	25%	135%	
Cumulative Total		43	123	223	458	
ASPs:	NMOS	\$80.00	\$50.00	\$30.00	\$22.00	\$32.66
	CMOS	0	0	\$45.00	\$25.00	\$25.00
	Overall	\$80.00	\$50.00	\$30.00	\$22.13	\$32.49
Revenue (\$M)		2.2	4.0	3.0	5.2	14.4
		1985				
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Year
Market Share						
U.S.		100.0%	100.0%	100.0%	89.4%	94.3%
Japan		0	0	0	10.6	5.7
Europe		0	0	0	0	0
Total		100.0%	100.0%	100.0%	100.0%	100.0%

S = Sampling
N/A = Not Available

(Continued)

MOS EPROM--Data

Table 7 (Continued)

512K MOS EPROM Shipment Data, 1984-1987

Company	MOS Process	1986				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	175	280	540	400	1,395
Fujitsu	C	25	25	25	25	100
General Instrument	C	S	10	25	100	135
	OTP	N/A	N/A	S	5	5
Hitachi	N	N/A	S	60	300	360
	C	N/A	N/A	N/A	N/A	0
Intel	N	250	400	730	900	2,280
Mitsubishi	N	N/A	S	58	365	423
National Semi.	C	N/A	S	0	0	0
Oki Electric	N	N/A	N/A	S	S	0
Texas Instruments	C	N/A	N/A	S	50	50
Toshiba	N	50	150	300	400	900
	OTP	N/A	N/A	S	30	30
VLSI Technology	C	S	0	3	5	8
WaferScale	C	N/A	N/A	N/A	N/A	0
Others	C	S	S	S	S	15
	N	475	830	1,688	2,395	5,388
	C	25	40	58	190	313
Total		500	870	1,746	2,585	5,701
Percentage Change from Previous Quarter						
		113%	74%	101%	48%	
Cumulative Total						
		958	1,828	3,574	6,159	
ASPs:						
	NMOS	\$14.00	\$12.00	\$12.00	\$11.00	\$11.73
	CMOS	\$16.50	\$15.50	\$15.00	\$13.00	\$13.97
	Overall	\$14.13	\$12.16	\$12.10	\$11.15	\$11.85
Revenue (\$M)						
		7.1	10.6	21.1	28.8	67.6
Market Share						
	U.S.	85.0%	79.9%	74.6%	56.7%	68.2%
	Japan	15.0	20.1	25.4	43.3	31.8
	Europe	0	0	0	0	0
Total		100.0%	100.0%	100.0%	100.0%	100.0%

S = Sampling
N/A = Not Available

(Continued)

MOS EPROM--Data

Table 7 (Continued)

512K MOS EPROM Shipment Data, 1984-1987

Company	MOS Process	1987				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	740	785	525	605	2,655
	C	S	5	25	285	315
Fujitsu	C	500	1,500	1,800	2,100	5,900
Hitachi	N	750	800	850	950	3,350
	C	S	0	0	0	0
Intel	N	800	1,200	1,800	2,700	6,500
Microchip Tech., Inc.	C	100	150	100	120	470
	OTP	10	10	20	20	60
Mitsubishi	N	750	800	1,200	1,450	4,200
National Semi.	C	0	0	0	0	0
NEC	C	N/A	S	0	1,050	1,050
Oki Electric	N	0	180	200	400	780
	N OTP	0	170	200	650	1,020
SGS-Thomson	N	N/A	1	50	350	401
Texas Instruments	C	100	150	200	400	850
Toshiba	N	550	500	700	800	2,550
	N OTP	200	180	200	170	750
VLSI Technology	C	5	5	5	8	23
WaferScale	C	0	0	0	0	0
	N	3,790	4,616	5,725	8,075	22,206
	C	715	1,820	2,150	3,983	8,668
Total		4,505	6,436	7,875	12,058	30,874
Percentage Change from Previous Quarter						
		74%	43%	22%	53%	
Cumulative Total						
		10,664	17,100	24,975	37,033	
ASPs:						
	NMOS	\$10.00	\$ 9.00	\$7.78	\$6.80	\$8.06
	CMOS	\$11.00	\$10.00	\$9.00	\$7.50	\$8.69
	Overall	\$10.16	\$ 9.28	\$8.11	\$7.03	\$8.23
Revenue (\$M)						
		45.8	59.7	63.9	84.8	254.2
Market Share						
		39.0%	35.8%	34.0%	34.3%	35.2%
	U.S.	61.0	64.2	65.4	62.8	63.5
	Japan	0	0	0.6	2.9	1.3
	Europe					
Total		100.0%	100.0%	100.0%	100.0%	100.0%

S = Sampling
N/A = Not Available

Source: Dataquest
May 1989

MOS EPROM--Data

Table 8

1-Mbit MOS EPROM Shipment Data, 1986-1987

Company	MOS Process	Technology Features	1986				Year
			1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	C	x16	1	1	4	6	12
Atmel	C	N/A	0	0	0	0	0
Fujitsu	C	x8, x16	N/A	S	S	1	1
General Instrument	C	x16	N/A	N/A	N/A	N/A	0
Hitachi	C	x8, x16	S	10	30	75	115
Intel	N	x8, x16	S	5	25	30	60
Motorola	C	N/A	S	S	S	0	0
National Semi.	C	x8, x16	N/A	N/A	N/A	S	0
NEC	C	x16	N/A	S	0	1	1
Oki Electric	C	x16	N/A	N/A	N/A	S	0
Texas Instruments	C	N/A	N/A	N/A	S	S	0
Toshiba	C	x8	N/A	S	5	15	20
Other	C	N/A	N/A	N/A	S	0	0
	N		0	5	25	30	60
	C		<u>1</u>	<u>11</u>	<u>39</u>	<u>98</u>	<u>149</u>
Total			1	16	64	128	209

Percentage Change from
Previous Quarter

0 3,100% 300% 100%

Cumulative Total

1 17 81 209

ASPs: NMOS
CMOS
Overall

\$110.00 \$80.00 \$50.00 \$42.00 \$48.50
\$150.00 \$70.00 \$66.00 \$60.00 \$62.62
\$150.00 \$73.13 \$59.75 \$55.78 \$58.56

Revenue (\$M)

0.1 1.2 3.8 7.1 12.2

Market Share

U.S.

100.0% 37.5% 45.3% 28.1% 34.3%

Japan

0 62.5 54.7 71.9 65.7

Europe

0 0 0 0 0

Total

100.0% 100.0% 100.0% 100.0% 100.0%

S = Sampling

N/A = Not Available

(Continued)

MOS EPROM--Data

Table 8 (Continued)

1-Mbit MOS EPROM Shipment Data, 1986-1987

			1987				
Company	MOS Process	Technology Features	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Year
AMD	C	x16	5	5	5	15	30
Fujitsu	C	x8, x16	N/A	5	5	10	15
Hitachi	C	x8, x16	100	70	150	250	570
Intel	N	x8, x16	50	30	80	150	310
Microchip Tech., Inc.	C		N/A	N/A	N/A	N/A	0
Mitsubishi	C	x8, x16	0	5	5	80	90
National Semi.	C	x8, x16	0	0	0	0	0
NEC	C	x8	N/A	0	50	300	350
	C	x16	N/A	0	50	100	150
Oki Electric	C	x8, x16	N/A	N/A	N/A	5	0
SGS-thomson	C		N/A	N/A	N/A	N/A	0
Texas Instruments	C		0	0	0	0	0
Toshiba	C	x8, x16	20	40	40	50	150
	N		50	30	80	150	310
	C		125	120	305	805	1,355
Total			175	150	385	955	1,655
Percentage Change from Previous Quarter			37%	(14%)	157%	148%	
Cumulative Total			384	534	919	1,874	
ASPs:	NMOS		\$26.00	\$24.00	\$24.00	\$24.00	\$24.32
	CMOS		\$40.00	\$32.00	\$28.00	\$26.00	\$28.27
	Overall		\$36.00	\$30.40	\$27.17	\$25.69	\$27.54
Revenue (\$M)			6.3	4.6	10.5	24.5	45.9
			1987				
			1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Year
Market Share							
U.S.			31.4%	23.3%	22.1%	17.3%	20.4%
Japan			68.6	76.7	77.9	82.7	79.6
Europe			0	0	0	0	0
Total			100.0%	100.0%	100.0%	100.0%	100.0%

S = Sampling
N/A = Not Available

Source: Dataquest
May 1989

MOS EPROM--Data

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MOS EPROM--Data Update

QUARTERLY COMPANY MOS EPROM SHIPMENT DATA

This section contains unit shipment data on MOS EPROMs for 1988. In addition to unit shipments for 16K, 32K, 64K, 128K, 256K, 512K, 1-Mbit, 2-Mbit, and 4-Mbit EPROMs, we have added our estimates of the worldwide billing prices for each product during the four quarters of the year. At the bottom of each table, we show market share data (units, not revenue) for companies based in the United States, Japan, Europe, and Asia/Pacific. The tables are organized as follows:

- Table 1—16K MOS EPROM Shipment Data, 1988
- Table 2—32K MOS EPROM Shipment Data, 1988
- Table 3—64K MOS EPROM Shipment Data, 1988
- Table 4—128K MOS EPROM Shipment Data, 1988
- Table 5—256K MOS EPROM Shipment Data, 1988
- Table 6—512K MOS EPROM Shipment Data, 1988
- Table 7—1-Mbit MOS EPROM Shipment Data, 1988
- Table 8—2-Mbit MOS EPROM Shipment Data, 1988
- Table 9—4-Mbit MOS EPROM Shipment Data, 1988

Definitions

Prices

Prices are Dataquest estimates of the billing prices during each quarter. These prices are averaged over all package types, lot sizes, and the entire speed mix, and they represent sales to both military and commercial accounts.

Quarterly Revenue

Quarterly revenue is calculated as units shipped times the prevailing price during that period.

MOS EPROM--Data Update

Table 1

16K MOS EPROM Shipment Data

Company	MOS Process	1988				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	275	345	440	480	1,540
Cypress	C	300	375	275	250	1,200
Intel	N	200	200	175	175	750
National Semi.	C	170	165	160	155	650
NEC	N	5	10	0	5	20
SGS-Thomson	N	790	1,040	710	500	3,040
	C	30	35	30	30	125
Texas Instruments	N	85	70	30	25	210
	C	55	50	75	80	260
WaferScale	C	<u>125</u>	<u>175</u>	<u>255</u>	<u>280</u>	<u>835</u>
	NMOS	1,355	1,665	1,355	1,185	5,560
	CMOS	<u>680</u>	<u>800</u>	<u>795</u>	<u>795</u>	<u>3,070</u>
Total		2,035	2,465	2,150	1,980	8,630
Percentage Change from Previous Quarter						
		(8%)	21%	(13%)	(8%)	
Cumulative Total		269,504	271,969	274,119	276,099	
ASPs:	NMOS	\$2.80	\$3.20	\$3.40	\$3.50	\$3.22
	CMOS	\$6.75	\$5.00	\$4.80	\$4.00	\$5.08
	Overall	\$4.12	\$3.78	\$3.92	\$3.70	\$3.88
Revenue (\$M)		8.4	9.3	8.4	7.3	33.5

	Market Share				
	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Year
U.S.	59.5%	56.0%	65.6%	73.0%	63.1%
Japan	0.2	0.4	0	0.3	0.2
Europe	<u>40.3</u>	<u>43.6</u>	<u>34.4</u>	<u>26.8</u>	<u>36.7</u>
Total	100.0%	100.0%	100.0%	100.0%	100.0%

*Columns may not add to totals shown because of rounding.

Source: Dataquest
May 1989

MOS EPROM--Data Update

Table 2

32K MOS EPROM Shipment Data

<u>Company</u>	<u>MOS Process</u>	<u>1988</u>				<u>Year</u>
		<u>1st Qtr.</u>	<u>2nd Qtr.</u>	<u>3rd Qtr.</u>	<u>4th Qtr.</u>	
AMD	N	460	540	350	230	1,580
Fujitsu	N	0	0	0	0	0
	C	0	0	0	0	0
Hitachi	N	0	0	0	0	0
ICT	C	6	12	12	16	46
Intel	N	1,250	1,250	1,200	1,000	4,700
	N OTP	0	0	0	0	0
Mitsubishi	N	0	0	0	0	0
National	C	600	525	400	375	1,900
NEC	N	10	20	0	0	30
Ricoh	C	0	0	0	0	0
SGS-Thomson	N	890	630	510	470	2,500
	C	25	15	30	30	100
Texas Instruments	N	<u>850</u>	<u>850</u>	<u>750</u>	<u>600</u>	<u>3,050</u>
	N	3,460	3,290	2,810	2,300	11,860
	C	<u>631</u>	<u>552</u>	<u>442</u>	<u>421</u>	<u>2,046</u>
Total		4,091	3,842	3,252	2,721	13,906
Percentage Change from Previous Quarter		12%	(6%)	(15%)	(16%)	
Cumulative Total		266,143	269,985	273,237	275,958	
ASPs:	NMOS	\$3.45	\$3.50	\$3.55	\$3.65	\$3.53
	CMOS	\$3.70	\$3.75	\$3.85	\$4.00	\$3.81
	Overall	\$3.49	\$3.54	\$3.59	\$3.70	\$3.57
Revenue (\$M)		14.3	13.6	11.7	10.1	49.6

	<u>Market Share</u>				
	<u>1st Qtr.</u>	<u>2nd Qtr.</u>	<u>3rd Qtr.</u>	<u>4th Qtr.</u>	<u>Year</u>
U.S.	77.4%	82.7%	83.4%	81.6%	81.1%
Japan	0.2	0.5	0	0	0.2
Europe	<u>22.4</u>	<u>16.8</u>	<u>16.6</u>	<u>18.4</u>	<u>18.7</u>
Total	100.0%	100.0%	100.0%	100.0%	100.0%

Source: Dataquest
May 1989

MOS EPROM--Data Update

Table 3

64K MOS EPROM Shipment Data

Company	MOS Process	1988				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	1,525	1,340	1,300	1,100	5,265
	C	0	0	0	5	5
Atmel	C	0	0	0	140	140
Cypress	C	100	80	80	50	310
Fujitsu	N	30	27	25	20	102
	C	100	100	70	80	350
Gold Star	C	25	80	100	100	305
	C 35ns	S	2	15	28	45
Hitachi	N	0	0	0	275	275
	C	0	0	0	0	0
	C OTP	0	0	0	0	0
Hyundai	C	40	55	115	150	360
ICT	C	11	16	19	23	69
Intel	N	2,100	2,400	2,000	2,300	8,800
	C	250	250	250	580	1,330
	C OTP	150	400	400	600	1,550
Microchip Tech.	C	509	375	554	400	1,838
	C OTP	100	96	150	150	496
Mitsubishi	N	1,200	1,000	1,000	800	4,000
	N OTP	300	300	200	160	960
Motorola	N	0	0	0	0	0
	N OTP	0	0	0	0	0
National Semi.	C	2,850	2,600	2,300	2,200	9,950
NEC	N	0	0	0	0	0
	C	200	100	150	40	490
	C OTP	50	50	50	40	190
Ok!	N	100	125	115	120	460
	N OTP	130	130	130	100	490
Ricoh	C	150	100	50	0	300
SEEQ	N	150	150	125	100	525
Seiko-Epson	C	110	125	100	100	435
SGS-Thomson	N	2,045	2,365	2,940	2,600	9,950
	C	330	105	200	250	885
	C OTP	100	100	150	400	750
Sharp	C	45	35	60	60	200
Signetics	C	1,200	1,700	1,900	1,200	6,000

(Continued)

MOS EPROM--Data Update

Table 3 (Continued)

64K MOS EPROM Shipment Data

<u>Company</u>	<u>MOS Process</u>	<u>1988</u>				<u>Year</u>
		<u>1st Qtr.</u>	<u>2nd Qtr.</u>	<u>3rd Qtr.</u>	<u>4th Qtr.</u>	
Texas Instruments	N	1,300	1,300	1,100	945	4,645
	C	25	50	100	100	275
	C OTP	30	100	110	120	360
Toshiba	N	300	280	260	250	1,090
	N OTP	500	450	400	350	1,700
WaferScale	C	<u>75</u>	<u>80</u>	<u>100</u>	<u>110</u>	<u>365</u>
	N	9,680	9,867	9,595	9,120	38,262
	C	<u>6,450</u>	<u>6,599</u>	<u>7,023</u>	<u>6,926</u>	<u>26,998</u>
Total		16,130	16,466	16,618	16,046	65,260
Percentage Change from Previous Quarter		(19%)	2%	1%	(3%)	
Cumulative Total		475,874	492,340	508,958	525,004	
ASPs:	NMOS	\$3.55	\$3.70	\$3.85	\$4.10	\$3.80
	CMOS	\$3.70	\$3.90	\$4.12	\$4.35	\$4.02
	Overall	\$3.61	\$3.78	\$3.96	\$4.21	\$3.89
Revenue (\$M)		58.2	62.2	65.9	67.5	253.9

	<u>Market Share</u>				<u>Year</u>
	<u>1st Qtr.</u>	<u>2nd Qtr.</u>	<u>3rd Qtr.</u>	<u>4th Qtr.</u>	
U.S.	56.9%	56.1%	51.7%	55.6%	55.0%
Japan	19.9	17.1	15.7	14.9	16.9
Europe	22.8	25.9	31.2	27.7	26.9
ROW	<u>0.4</u>	<u>0.8</u>	<u>1.4</u>	<u>1.7</u>	<u>1.1</u>
Total	100.0%	100.0%	100.0%	100.0%	100.0%

Note: Columns may not add to totals shown because of rounding.

Source: Dataquest
May 1989

MOS EPROM--Data Update

Table 4

128K MOS EPROM Shipment Data

<u>Company</u>	<u>MOS Process</u>	<u>1988</u>				<u>Year</u>
		<u>1st Qtr.</u>	<u>2nd Qtr.</u>	<u>3rd Qtr.</u>	<u>4th Qtr.</u>	
AMD	N	1,800	2,500	1,700	1,500	7,500
	C	0	0	0	5	5
Catalyst	N OTP	0	0	10	15	25
Fujitsu	N	900	1,100	875	700	3,575
	C	700	870	500	540	2,610
Hitachi	N	0	0	0	0	0
Intel	N	2,200	2,600	2,400	2,600	9,800
	N OTP	100	150	100	100	450
	C	300	200	300	300	1,100
	C OTP	0	50	50	50	150
Microchip Tech.	C	469	1,113	1,100	1,200	3,882
	C OTP	256	303	321	350	1,230
Mitsubishi	N	1,200	900	900	580	3,580
	C	150	250	150	100	650
	N OTP	200	150	100	100	550
	C OTP	0	0	0	0	0
National	C	370	360	220	200	1,150
NEC	N	300	600	190	170	1,260
Oki	N	100	100	110	120	430
	N OTP	250	275	240	260	1,025
SEEQ	N	50	25	0	0	75
Seiko-Epson	N	0	0	0	0	0
SGS-Thomson	N	1,980	2,490	3,180	3,300	10,950
Texas Instruments	N	100	100	100	100	400
	C	1,800	2,000	1,800	1,000	6,600
	C OTP	20	70	150	100	340
Toshiba	N	600	550	500	450	2,100
	N OTP	700	650	550	500	2,400
WaferScale	C	<u>20</u>	<u>20</u>	<u>25</u>	<u>30</u>	<u>95</u>
	N	10,480	12,190	10,955	10,495	44,120
	C	<u>4,085</u>	<u>5,236</u>	<u>4,616</u>	<u>3,875</u>	<u>17,812</u>
Total		14,565	17,426	15,571	14,370	61,932
Percentage Change from Previous Quarter		(2%)	20%	(11%)	(8%)	

(Continued)

MOS EPROM--Data Update

Table 4 (Continued)

128K MOS EPROM Shipment Data

<u>Company</u>	<u>MOS Process</u>	<u>1988</u>				<u>Year</u>
		<u>1st Qtr.</u>	<u>2nd Qtr.</u>	<u>3rd Qtr.</u>	<u>4th Qtr.</u>	
Cumulative Total		221,961	239,387	254,958	269,328	
ASPs:	NMOS	\$3.85	\$3.90	\$3.95	\$4.10	\$3.95
	CMOS	\$4.40	\$4.45	\$4.50	\$4.55	\$4.47
	Overall	\$4.00	\$4.07	\$4.11	\$4.22	\$4.10
Revenue (\$M)		58.3	70.8	64.0	60.7	253.9
<u>Market Share</u>						
		<u>1st Qtr.</u>	<u>2nd Qtr.</u>	<u>3rd Qtr.</u>	<u>4th Qtr.</u>	<u>Year</u>
U.S.		51.4%	54.5%	53.2%	52.5%	53.0%
Japan		35.0	31.2	26.4	24.5	29.4
Europe		<u>13.6</u>	<u>14.3</u>	<u>20.4</u>	<u>23.0</u>	<u>17.7</u>
Total		100.0%	100.0%	100.0%	100.0%	100.0%

Note: Columns may not add to totals shown because of rounding.

Source: Dataquest
May 1989

MOS EPROM--Data Update

Table 5

256K MOS EPROM Shipment Data

Company	MOS Process	1988				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	1,585	1,535	1,400	1,260	5,780
	C	250	300	720	820	2,090
Atmel	C	45	51	50	54	200
Catalyst	N OTP	0	0	25	50	75
Cypress	C	0	20	70	110	200
Fujitsu	N	1,000	1,100	1,000	1,000	4,100
	C	2,600	2,400	2,500	2,500	10,000
Hitachi	N	0	0	0	0	0
	C	0	0	0	0	0
	C OTP	0	0	0	0	0
Intel	N	4,500	4,900	4,600	4,800	18,800
	C	300	400	450	1,200	2,350
	N OTP	550	650	400	550	2,150
	C OTP	150	350	250	300	1,050
Microchip Tech.	N	1,500	1,800	800	300	4,400
	C	300	700	1,500	2,900	5,400
	C OTP	200	400	600	750	1,950
Mitsubishi	N	1,200	1,200	1,200	800	4,400
	C	1,000	1,300	1,200	1,000	4,500
	N OTP	200	350	200	50	800
	C OTP	200	450	600	700	1,950
National Semi.	C	3,615	3,900	3,800	3,312	14,627
NEC	N	250	300	150	100	800
	C	900	1,200	1,000	1,000	4,100
Oki	N	120	105	110	80	415
	N OTP	430	360	300	320	1,410
Ricoh	C	25	30	35	40	130
SEEQ	C	120	80	70	70	340
Seiko Epson	C	30	55	70	70	225
SGS-Thomson	N	2,010	2,045	2,765	3,350	10,170
	C	0	20	315	520	855
	C OTP	0	0	50	400	450
Signetics	C	1,080	1,100	1,300	1,020	4,500
Sharp	C	50	50	80	80	260
Texas Instruments	C	2,200	2,200	2,300	2,100	8,800
	C OTP	50	100	200	300	650

(Continued)

MOS EPROM---Data Update

Table 5 (Continued)
256K MOS EPROM Shipment Data

<u>Company</u>	<u>MOS Process</u>	<u>1988</u>				<u>Year</u>
		<u>1st Qtr.</u>	<u>2nd Qtr.</u>	<u>3rd Qtr.</u>	<u>4th Qtr.</u>	
Toshiba	N	900	750	660	500	2,810
	C	1,200	1,150	1,050	1,000	4,400
	N OTP	600	500	450	350	1,900
	C OTP	900	800	750	700	3,150
WaferScale	C	<u>100</u>	<u>125</u>	<u>180</u>	<u>200</u>	<u>605</u>
	N	14,845	15,595	14,060	13,510	58,010
	C	<u>15,315</u>	<u>17,181</u>	<u>19,140</u>	<u>21,146</u>	<u>72,782</u>
Total		30,160	32,776	33,200	34,656	130,792
Percentage Change from Previous Quarter		2%	9%	1%	4%	
Cumulative Total		243,153	275,929	309,129	343,785	
ASPs:	NMOS	\$4.50	\$4.50	\$4.50	\$4.60	\$4.52
	CMOS	\$5.20	\$5.10	\$5.10	\$5.05	\$5.11
	Overall	\$4.86	\$4.81	\$4.85	\$4.87	\$4.85
Revenue (\$M)		146.4	157.8	160.9	168.9	634.1
		<u>Market Share</u>				<u>Year</u>
		<u>1st Qtr.</u>	<u>2nd Qtr.</u>	<u>3rd Qtr.</u>	<u>4th Qtr.</u>	
U.S.		51.3%	53.4%	52.5%	55.0%	53.1%
Japan		38.5	36.9	34.2	29.7	34.7
Europe		<u>10.2</u>	<u>9.7</u>	<u>13.3</u>	<u>15.3</u>	<u>12.2</u>
Total		100.0%	100.0%	100.0%	100.0%	100.0%

Note: Columns may not add to totals shown because of rounding.

Source: Dataquest
May 1989

MOS EPROM--Data Update

Table 6

512K MOS EPROM Shipment Data

<u>Company</u>	<u>MOS Process</u>	<u>1988</u>				<u>Year</u>
		<u>1st Qtr.</u>	<u>2nd Qtr.</u>	<u>3rd Qtr.</u>	<u>4th Qtr.</u>	
AMD	N	550	1,200	1,340	1,400	4,490
	C	495	485	560	625	2,165
Atmel	C	32	36	28	29	125
Catalyst	N OTP	0	0	20	30	50
Fujitsu	C	1,700	1,800	1,600	1,800	6,900
Hitachi	N	1,700	1,500	2,000	1,800	7,000
	C	0	0	0	0	0
Intel	N	2,700	2,500	1,900	1,900	9,000
Microchip Tech.	C	120	100	200	900	1,320
	C OTP	40	50	100	300	490
Mitsubishi	N	2,000	1,700	1,200	1,100	6,000
	C	N/A	N/A	50	500	550
National Semi.	C	0	0	0	0	0
NEC	C	1,100	1,100	1,000	800	4,000
Oki	N	180	110	100	90	480
	N OTP	670	610	600	660	2,540
SGS-Thomson	N	605	1,055	1,125	1,700	4,485
Texas Instruments	C	900	1,200	1,300	1,200	4,600
	C OTP	50	100	120	150	420
Toshiba	N	800	750	700	600	2,850
	N OTP	700	600	550	450	2,300
	C	0	30	120	300	450
	C OTP	0	0	40	60	100
WaferScale	C	<u>5</u>	<u>50</u>	<u>55</u>	<u>70</u>	<u>175</u>
	N	9,905	10,025	9,535	9,730	39,195
	C	<u>4,437</u>	<u>4,951</u>	<u>5,173</u>	<u>6,734</u>	<u>21,295</u>
Total		14,342	14,976	14,708	16,464	60,490
Percentage Change from Previous Quarter		20%	4%	(2%)	12%	
Cumulative Total		51,155	66,131	80,839	97,303	

(Continued)

MOS EPROM--Data Update

Table 6 (Continued)

512K MOS EPROM Shipment Data

<u>Company</u>	<u>MOS Process</u>	<u>1988</u>				<u>Year</u>
		<u>1st Qtr.</u>	<u>2nd Qtr.</u>	<u>3rd Qtr.</u>	<u>4th Qtr.</u>	
ASPs:	NMOS	\$7.20	\$7.00	\$7.10	\$7.20	\$7.12
	CMOS	\$8.00	\$7.80	\$7.75	\$7.70	\$7.80
	Overall	\$7.45	\$7.26	\$7.33	\$7.40	\$7.36
Japan 4Q spot 11.94 OEM 7.16						
Revenue (\$M)		106.8	108.8	107.8	121.9	445.3
<u>Market Share</u>						
		<u>1st Qtr.</u>	<u>2nd Qtr.</u>	<u>3rd Qtr.</u>	<u>4th Qtr.</u>	<u>Year</u>
U.S.		34.1%	38.2%	38.2%	40.1%	37.8%
Japan		61.7	54.8	54.1	49.6	54.8
Europe		4.2	7.0	7.6	10.3	7.4
Total		100.0%	100.0%	100.0%	100.0%	100.0%

N/A = Not Available

Source: Dataquest
May 1989

MOS EPROM--Data Update

Table 7

1-Mbit MOS EPROM Shipment Data

Company	Technology	Max. Acc.T.	Features	1988				Year
				1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	CMOS	150ns	x8	0	5	105	180	290
	CMOS	150ns	x16	30	50	70	90	240
Atmel	CMOS	70ns	x16	S	0	5	10	15
Fujitsu	CMOS		x8,x16	150	300	450	520	1,420
Hitachi	CMOS	110ns	x8,x16	300	300	275	225	1,100
Intel	NMOS		x8,x16	180	190	250	650	1,270
Mitsubishi	CMOS	120ns	x8,x16	100	300	450	750	1,600
	CMOS/OTP		x8,x16	N/A	S	40	80	120
NEC	CMOS		x8	280	160	370	420	1,230
	CMOS		x16	100	80	240	150	570
Oki	CMOS		x8,x16	0	0	0	0	0
SGS-Thomson	CMOS		x16	N/A	N/A	S	50	50
Sharp	CMOS		x8,x16	0	5	10	30	45
Toshiba	CMOS		x8	150	175	200	350	875
	CMOS	150ns	x16	N/A	S	5	10	15
	CMOS/OTP		x8	N/A	S	0	5	5
	CMOS/OTP		x16	20	20	50	100	190
	N			180	190	250	650	1,270
	C			1,130	1,395	2,270	2,970	7,765
Total				1,310	1,585	2,520	3,620	9,035
Percentage Change from Previous Quarter				37%	21%	59%	44%	
Cumulative Total				1,310	2,895	5,415	9,035	
ASPs:	NMOS			\$25.00	\$23.00	\$22.00	\$21.00	\$22.06
	CMOS			\$21.00	\$20.00	\$19.00	\$18.00	\$19.09
	Overall			\$21.55	\$20.36	\$19.30	\$18.54	\$19.51
Japan 1M spot 27.85 OEM 12.73								
Revenue (\$M)			28.2	32.3	48.6	67.1	176.2	

(Continued)

MOS EPROM--Data Update

Table 7 (Continued)

1-Mbit MOS EPROM Shipment Data

	Market Share				Year
	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
U.S.	16.0%	15.5%	17.1%	25.7%	20.1%
Japan	84.0	84.5	82.9	72.9	79.4
Europe	0	0	0	1.4	0.6
Total	100.0%	100.0%	100.0%	100.0%	100.0%

N/A = Not Available

S = Sampled

Source: Dataquest
May 1989

Table 8

2-Mbit MOS EPROM Shipment Data

Company	MOS Process	Technology Features	1988				Year
			1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
NEC	CMOS	x8 150ns	N/A	N/A	S	0	0
Total			0	0	0	0	0
Cumulative Total			0	0	0	0	
ASPs:	NMOS						0
	CMOS						0
	Overall						0
Revenue (\$M)			0	0	0	0	0

	Market Share				Year
	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
U.S.	0	0	0	0	0
Japan	0	0	0	0	0
Europe	0	0	0	0	0
Total	0	0	0	0	0

N/A = Not Available

S = Sampled

Source: Dataquest
May 1989

MOS EPROM--Data Update

Table 9

4-Mbit MOS EPROM Shipment Data

<u>Company</u>	<u>MOS Process</u>	<u>Technology Features</u>	<u>1988</u>				<u>Year</u>
			<u>1st Qtr.</u>	<u>2nd Qtr.</u>	<u>3rd Qtr.</u>	<u>4th Qtr.</u>	
Fujitsu	CMOS	x8	40	50	60	80	230
Intel	CMOS	x16 90ns	N/A	N/A	N/A	N/A	0
NEC	CMOS	x8 150ns	N/A	N/A	N/A	S	0
Toshiba	CMOS	x8 120ns	N/A	N/A	N/A	N/A	0
Total			40	50	60	80	230
Percentage Change from Previous Quarter			-	25%	20%	33%	
Cumulative Total			40	90	150	230	
ASPs:	CMOS		\$120.00	\$80.00	\$55.00	\$40.00	\$66.52
	Overall		\$120.00	\$80.00	\$55.00	\$40.00	\$66.52
Revenue (\$M)			4.8	4.0	3.3	3.2	15.3
			<u>Market Share</u>				
			<u>1st Qtr.</u>	<u>2nd Qtr.</u>	<u>3rd Qtr.</u>	<u>4th Qtr.</u>	<u>Year</u>
U.S.			0	0	0	0	0
Japan			100.0%	100.0%	100.0%	100.0%	100.0%
Europe			0	0	0	0	0
Total			100.0%	100.0%	100.0%	100.0%	100.0%

N/A = Not Available
S = Sampled

Source: Dataquest
May 1989

MOS EPROM--Data Update

QUARTERLY COMPANY MOS EPROM SHIPMENT DATA

This section contains unit shipment data on MOS EPROMs for 1988. In addition to unit shipments for 16K, 32K, 64K, 128K, 256K, 512K, 1-Mbit, 2-Mbit, and 4-Mbit EPROMs, we have added our estimates of the worldwide billing prices for each product during the four quarters of the year. At the bottom of each table, we show market share data (units, not revenue) for companies based in the United States, Japan, Europe, and Asia/Pacific. The tables are organized as follows:

- Table 1—16K MOS EPROM Shipment Data, 1988
- Table 2—32K MOS EPROM Shipment Data, 1988
- Table 3—64K MOS EPROM Shipment Data, 1988
- Table 4—128K MOS EPROM Shipment Data, 1988
- Table 5—256K MOS EPROM Shipment Data, 1988
- Table 6—512K MOS EPROM Shipment Data, 1988
- Table 7—1-Mbit MOS EPROM Shipment Data, 1988
- Table 8—2-Mbit MOS EPROM Shipment Data, 1988
- Table 9—4-Mbit MOS EPROM Shipment Data, 1988

Definitions

Prices

Prices are Dataquest estimates of the billing prices during each quarter. These prices are averaged over all package types, lot sizes, and the entire speed mix, and they represent sales to both military and commercial accounts.

Quarterly Revenue

Quarterly revenue is calculated as units shipped times the prevailing price during that period.

MOS EPROM--Data Update

Table 1

16K MOS EPROM Shipment Data

<u>Company</u>	<u>MOS Process</u>	<u>1988</u>				<u>Year</u>
		<u>1st Qtr.</u>	<u>2nd Qtr.</u>	<u>3rd Qtr.</u>	<u>4th Qtr.</u>	
AMD	N	275	345	440	480	1,540
Cypress	C	300	375	275	250	1,200
Intel	N	200	200	175	175	750
National Semi.	C	170	165	160	155	650
NEC	N	5	10	0	5	20
SGS-Thomson	N	790	1,040	710	500	3,040
	C	30	35	30	30	125
Texas Instruments	N	85	70	30	25	210
	C	55	50	75	80	260
WaferScale	C	<u>125</u>	<u>175</u>	<u>255</u>	<u>280</u>	<u>835</u>
	NMOS	1,355	1,665	1,355	1,185	5,560
	CMOS	<u>680</u>	<u>800</u>	<u>795</u>	<u>795</u>	<u>3,070</u>
Total		2,035	2,465	2,150	1,980	8,630
Percentage Change from Previous Quarter		(8%)	21%	(13%)	(8%)	
Cumulative Total		269,504	271,969	274,119	276,099	
ASPs:	NMOS	\$2.80	\$3.20	\$3.40	\$3.50	\$3.22
	CMOS	\$6.75	\$5.00	\$4.80	\$4.00	\$5.08
	Overall	\$4.12	\$3.78	\$3.92	\$3.70	\$3.88
Revenue (\$M)		8.4	9.3	8.4	7.3	33.5

	<u>Market Share</u>				<u>Year</u>
	<u>1st Qtr.</u>	<u>2nd Qtr.</u>	<u>3rd Qtr.</u>	<u>4th Qtr.</u>	
U.S.	59.5%	56.0%	65.6%	73.0%	63.1%
Japan	0.2	0.4	0	0.3	0.2
Europe	<u>40.3</u>	<u>43.6</u>	<u>34.4</u>	<u>26.8</u>	<u>36.7</u>
Total	100.0%	100.0%	100.0%	100.0%	100.0%

*Columns may not add to totals shown because of rounding.

Source: Dataquest
May 1989

MOS EPROM--Data Update

Table 2

32K MOS EPROM Shipment Data

<u>Company</u>	<u>MOS Process</u>	<u>1988</u>				<u>Year</u>
		<u>1st Qtr.</u>	<u>2nd Qtr.</u>	<u>3rd Qtr.</u>	<u>4th Qtr.</u>	
AMD	N	460	540	350	230	1,580
Fujitsu	N	0	0	0	0	0
	C	0	0	0	0	0
Hitachi	N	0	0	0	0	0
ICT	C	6	12	12	16	46
Intel	N	1,250	1,250	1,200	1,000	4,700
	N OTP	0	0	0	0	0
Mitsubishi	N	0	0	0	0	0
National	C	600	525	400	375	1,900
NEC	N	10	20	0	0	30
Ricoh	C	0	0	0	0	0
SGS-Thomson	N	890	630	510	470	2,500
	C	25	15	30	30	100
Texas Instruments	N	<u>850</u>	<u>850</u>	<u>750</u>	<u>600</u>	<u>3,050</u>
	N	3,460	3,290	2,810	2,300	11,860
	C	<u>631</u>	<u>552</u>	<u>442</u>	<u>421</u>	<u>2,046</u>
Total		4,091	3,842	3,252	2,721	13,906
Percentage Change from Previous Quarter		12%	(6%)	(15%)	(16%)	
Cumulative Total		266,143	269,985	273,237	275,958	
ASPs:	NMOS	\$3.45	\$3.50	\$3.55	\$3.65	\$3.53
	CMOS	\$3.70	\$3.75	\$3.85	\$4.00	\$3.81
	Overall	\$3.49	\$3.54	\$3.59	\$3.70	\$3.57
Revenue (\$M)		14.3	13.6	11.7	10.1	49.6

	<u>Market Share</u>				
	<u>1st Qtr.</u>	<u>2nd Qtr.</u>	<u>3rd Qtr.</u>	<u>4th Qtr.</u>	<u>Year</u>
U.S.	77.4%	82.7%	83.4%	81.6%	81.1%
Japan	0.2	0.5	0	0	0.2
Europe	<u>22.4</u>	<u>16.8</u>	<u>16.6</u>	<u>18.4</u>	<u>18.7</u>
Total	100.0%	100.0%	100.0%	100.0%	100.0%

Source: Dataquest
May 1989

MOS EPROM--Data Update

Table 3
64K MOS EPROM Shipment Data

<u>Company</u>	<u>MOS Process</u>	<u>1988</u>				<u>Year</u>
		<u>1st Qtr.</u>	<u>2nd Qtr.</u>	<u>3rd Qtr.</u>	<u>4th Qtr.</u>	
AMD	N	1,525	1,340	1,300	1,100	5,265
	C	0	0	0	5	5
Atmel	C	0	0	0	140	140
Cypress	C	100	80	80	50	310
Fujitsu	N	30	27	25	20	102
	C	100	100	70	80	350
Gold Star	C	25	80	100	100	305
	C 35ns	S	2	15	28	45
Hitachi	N	0	0	0	275	275
	C	0	0	0	0	0
	C OTP	0	0	0	0	0
Hyundai	C	40	55	115	150	360
ICT	C	11	16	19	23	69
Intel	N	2,100	2,400	2,000	2,300	8,800
	C	250	250	250	580	1,330
	C OTP	150	400	400	600	1,550
Microchip Tech.	C	509	375	554	400	1,838
	C OTP	100	96	150	150	496
Mitsubishi	N	1,200	1,000	1,000	800	4,000
	N OTP	300	300	200	160	960
Motorola	N	0	0	0	0	0
	N OTP	0	0	0	0	0
National Semi.	C	2,850	2,600	2,300	2,200	9,950
NEC	N	0	0	0	0	0
	C	200	100	150	40	490
	C OTP	50	50	50	40	190
Okii	N	100	125	115	120	460
	N OTP	130	130	130	100	490
Ricoh	C	150	100	50	0	300
SEEQ	N	150	150	125	100	525
Seiko-Epson	C	110	125	100	100	435
SGS-Thomson	N	2,045	2,365	2,940	2,600	9,950
	C	330	105	200	250	885
	C OTP	100	100	150	400	750
Sharp	C	45	35	60	60	200
Signetics	C	1,200	1,700	1,900	1,200	6,000

(Continued)

MOS EPROM--Data Update

Table 3 (Continued)
64K MOS EPROM Shipment Data

<u>Company</u>	<u>MOS Process</u>	<u>1988</u>				<u>Year</u>
		<u>1st Qtr.</u>	<u>2nd Qtr.</u>	<u>3rd Qtr.</u>	<u>4th Qtr.</u>	
Texas Instruments	N	1,300	1,300	1,100	945	4,645
	C	25	50	100	100	275
	C OTP	30	100	110	120	360
Toshiba	N	300	280	260	250	1,090
	N OTP	500	450	400	350	1,700
WaferScale	C	<u>75</u>	<u>80</u>	<u>100</u>	<u>110</u>	<u>365</u>
	N	9,680	9,867	9,595	9,120	38,262
	C	<u>6,450</u>	<u>6,599</u>	<u>7,023</u>	<u>6,926</u>	<u>26,998</u>
Total		16,130	16,466	16,618	16,046	65,260
Percentage Change from Previous Quarter		(19%)	2%	1%	(3%)	
Cumulative Total		475,874	492,340	508,958	525,004	
ASPs:	NMOS	\$3.55	\$3.70	\$3.85	\$4.10	\$3.80
	CMOS	\$3.70	\$3.90	\$4.12	\$4.35	\$4.02
	Overall	\$3.61	\$3.78	\$3.96	\$4.21	\$3.89
Revenue (\$M)		58.2	62.2	65.9	67.5	253.9
		<u>Market Share</u>				<u>Year</u>
		<u>1st Qtr.</u>	<u>2nd Qtr.</u>	<u>3rd Qtr.</u>	<u>4th Qtr.</u>	
U.S.		56.9%	56.1%	51.7%	55.6%	55.0%
Japan		19.9	17.1	15.7	14.9	16.9
Europe		22.8	25.9	31.2	27.7	26.9
ROW		<u>0.4</u>	<u>0.8</u>	<u>1.4</u>	<u>1.7</u>	<u>1.1</u>
Total		100.0%	100.0%	100.0%	100.0%	100.0%

Note: Columns may not add to totals shown because of rounding.

Source: Dataquest
May 1989

MOS EPROM--Data Update

Table 4
128K MOS EPROM Shipment Data

Company	MOS Process	1988				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	1,800	2,500	1,700	1,500	7,500
	C	0	0	0	5	5
Catalyst	N OTP	0	0	10	15	25
Fujitsu	N	900	1,100	875	700	3,575
	C	700	870	500	540	2,610
Hitachi	N	0	0	0	0	0
Intel	N	2,200	2,600	2,400	2,600	9,800
	N OTP	100	150	100	100	450
	C	300	200	300	300	1,100
	C OTP	0	50	50	50	150
Microchip Tech.	C	469	1,113	1,100	1,200	3,882
	C OTP	256	303	321	350	1,230
Mitsubishi	N	1,200	900	900	580	3,580
	C	150	250	150	100	650
	N OTP	200	150	100	100	550
	C OTP	0	0	0	0	0
National	C	370	360	220	200	1,150
NEC	N	300	600	190	170	1,260
Oki	N	100	100	110	120	430
	N OTP	250	275	240	260	1,025
SEEQ	N	50	25	0	0	75
Seiko-Epson	N	0	0	0	0	0
SGS-Thomson	N	1,980	2,490	3,180	3,300	10,950
Texas Instruments	N	100	100	100	100	400
	C	1,800	2,000	1,800	1,000	6,600
	C OTP	20	70	150	100	340
Toshiba	N	600	550	500	450	2,100
	N OTP	700	650	550	500	2,400
WaferScale	C	20	20	25	30	95
	N	10,480	12,190	10,955	10,495	44,120
	C	4,085	5,236	4,616	3,875	17,812
Total		14,565	17,426	15,571	14,370	61,932
Percentage Change from Previous Quarter		(2%)	20%	(11%)	(8%)	

(Continued)

MOS EPROM--Data Update

Table 4 (Continued)
128K MOS EPROM Shipment Data

<u>Company</u>	<u>MOS Process</u>	<u>1988</u>				<u>Year</u>
		<u>1st Qtr.</u>	<u>2nd Qtr.</u>	<u>3rd Qtr.</u>	<u>4th Qtr.</u>	
Cumulative Total		221,961	239,387	254,958	269,328	
ASPs:	NMOS	\$3.85	\$3.90	\$3.95	\$4.10	\$3.95
	CMOS	\$4.40	\$4.45	\$4.50	\$4.55	\$4.47
	Overall	\$4.00	\$4.07	\$4.11	\$4.22	\$4.10
Revenue (\$M)		58.3	70.8	64.0	60.7	253.9
<u>Market Share</u>						
		<u>1st Qtr.</u>	<u>2nd Qtr.</u>	<u>3rd Qtr.</u>	<u>4th Qtr.</u>	<u>Year</u>
U.S.		51.4%	54.5%	53.2%	52.5%	53.0%
Japan		35.0	31.2	26.4	24.5	29.4
Europe		13.6	14.3	20.4	23.0	17.7
Total		100.0%	100.0%	100.0%	100.0%	100.0%

Note: Columns may not add to totals shown because of rounding.

Source: Dataquest
May 1989

MOS EPROM--Data Update

Table 5

256K MOS EPROM Shipment Data

Company	MOS Process	1988				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	1,585	1,535	1,400	1,260	5,780
	C	250	300	720	820	2,090
Atmel	C	45	51	50	54	200
Catalyst	N OTP	0	0	25	50	75
Cypress	C	0	20	70	110	200
Fujitsu	N	1,000	1,100	1,000	1,000	4,100
	C	2,600	2,400	2,500	2,500	10,000
Hitachi	N	0	0	0	0	0
	C	0	0	0	0	0
	C OTP	0	0	0	0	0
Intel	N	4,500	4,900	4,600	4,800	18,800
	C	300	400	450	1,200	2,350
	N OTP	550	650	400	550	2,150
	C OTP	150	350	250	300	1,050
Microchip Tech.	N	1,500	1,800	800	300	4,400
	C	300	700	1,500	2,900	5,400
	C OTP	200	400	600	750	1,950
Mitsubishi	N	1,200	1,200	1,200	800	4,400
	C	1,000	1,300	1,200	1,000	4,500
	N OTP	200	350	200	50	800
	C OTP	200	450	600	700	1,950
National Semi.	C	3,615	3,900	3,800	3,312	14,627
NEC	N	250	300	150	100	800
	C	900	1,200	1,000	1,000	4,100
Oki	N	120	105	110	80	415
	N OTP	430	360	300	320	1,410
Ricoh	C	25	30	35	40	130
SEEQ	C	120	80	70	70	340
Seiko Epson	C	30	55	70	70	225
SGS-Thomson	N	2,010	2,045	2,765	3,350	10,170
	C	0	20	315	520	855
	C OTP	0	0	50	400	450
Signetics	C	1,080	1,100	1,300	1,020	4,500
Sharp	C	50	50	80	80	260
Texas Instruments	C	2,200	2,200	2,300	2,100	8,800
	C OTP	50	100	200	300	650

(Continued)

MOS EPROM--Data Update

Table 5 (Continued)

256K MOS EPROM Shipment Data

<u>Company</u>	<u>MOS Process</u>	<u>1988</u>				<u>Year</u>
		<u>1st Qtr.</u>	<u>2nd Qtr.</u>	<u>3rd Qtr.</u>	<u>4th Qtr.</u>	
Toshiba	N	900	750	660	500	2,810
	C	1,200	1,150	1,050	1,000	4,400
	N OTP	600	500	450	350	1,900
	C OTP	900	800	750	700	3,150
WaferScale	C	<u>100</u>	<u>125</u>	<u>180</u>	<u>200</u>	<u>605</u>
	N	14,845	15,595	14,060	13,510	58,010
	C	<u>15,315</u>	<u>17,181</u>	<u>19,140</u>	<u>21,146</u>	<u>72,782</u>
Total		30,160	32,776	33,200	34,656	130,792
Percentage Change from Previous Quarter		2%	9%	1%	4%	
Cumulative Total		243,153	275,929	309,129	343,785	
ASPs:	NMOS	\$4.50	\$4.50	\$4.50	\$4.60	\$4.52
	CMOS	\$5.20	\$5.10	\$5.10	\$5.05	\$5.11
	Overall	\$4.86	\$4.81	\$4.85	\$4.87	\$4.85
Revenue (\$M)		146.4	157.8	160.9	168.9	634.1
		<u>Market Share</u>				<u>Year</u>
		<u>1st Qtr.</u>	<u>2nd Qtr.</u>	<u>3rd Qtr.</u>	<u>4th Qtr.</u>	
U.S.		51.3%	53.4%	52.5%	55.0%	53.1%
Japan		38.5	36.9	34.2	29.7	34.7
Europe		<u>10.2</u>	<u>9.7</u>	<u>13.3</u>	<u>15.3</u>	<u>12.2</u>
Total		100.0%	100.0%	100.0%	100.0%	100.0%

Note: Columns may not add to totals shown because of rounding.

Source: Dataquest
May 1989

MOS EPROM--Data Update

Table 6
512K MOS EPROM Shipment Data

<u>Company</u>	<u>MOS Process</u>	<u>1988</u>				<u>Year</u>
		<u>1st Qtr.</u>	<u>2nd Qtr.</u>	<u>3rd Qtr.</u>	<u>4th Qtr.</u>	
AMD	N	550	1,200	1,340	1,400	4,490
	C	495	485	560	625	2,165
Atmel	C	32	36	28	29	125
Catalyst	N OTP	0	0	20	30	50
Fujitsu	C	1,700	1,800	1,600	1,800	6,900
Hitachi	N	1,700	1,500	2,000	1,800	7,000
	C	0	0	0	0	0
Intel	N	2,700	2,500	1,900	1,900	9,000
Microchip Tech.	C	120	100	200	900	1,320
	C OTP	40	50	100	300	490
Mitsubishi	N	2,000	1,700	1,200	1,100	6,000
	C	N/A	N/A	50	500	550
National Semi.	C	0	0	0	0	0
NEC	C	1,100	1,100	1,000	800	4,000
Oki	N	180	110	100	90	480
	N OTP	670	610	600	660	2,540
SGS-Thomson	N	605	1,055	1,125	1,700	4,485
Texas Instruments	C	900	1,200	1,300	1,200	4,600
	C OTP	50	100	120	150	420
Toshiba	N	800	750	700	600	2,850
	N OTP	700	600	550	450	2,300
	C	0	30	120	300	450
	C OTP	0	0	40	60	100
WaferScale	C	<u>5</u>	<u>50</u>	<u>55</u>	<u>70</u>	<u>175</u>
	N	9,905	10,025	9,535	9,730	39,195
	C	<u>4,437</u>	<u>4,951</u>	<u>5,173</u>	<u>6,734</u>	<u>21,295</u>
Total		14,342	14,976	14,708	16,464	60,490
Percentage Change from Previous Quarter		20%	4%	(2%)	12%	
Cumulative Total		51,155	66,131	80,839	97,303	

(Continued)

MOS EPROM--Data Update

Table 6 (Continued)

512K MOS EPROM Shipment Data

<u>Company</u>	<u>MOS Process</u>	<u>1988</u>				<u>Year</u>
		<u>1st Qtr.</u>	<u>2nd Qtr.</u>	<u>3rd Qtr.</u>	<u>4th Qtr.</u>	
ASPs:	NMOS	\$7.20	\$7.00	\$7.10	\$7.20	\$7.12
	CMOS	\$8.00	\$7.80	\$7.75	\$7.70	\$7.80
	Overall	\$7.45	\$7.26	\$7.33	\$7.40	\$7.36
Japan 4Q spot 11.94 OEM 7.16						
Revenue (\$M)		106.8	108.8	107.8	121.9	445.3

	<u>Market Share</u>				
	<u>1st Qtr.</u>	<u>2nd Qtr.</u>	<u>3rd Qtr.</u>	<u>4th Qtr.</u>	<u>Year</u>
U.S.	34.1%	38.2%	38.2%	40.1%	37.8%
Japan	61.7	54.8	54.1	49.6	54.8
Europe	4.2	7.0	7.6	10.3	7.4
Total	100.0%	100.0%	100.0%	100.0%	100.0%

N/A = Not Available

Source: Dataquest
May 1989

MOS EPROM--Data Update

Table 7

1-Mbit MOS EPROM Shipment Data

<u>Company</u>	<u>Technology</u>	<u>Max. Acc.T.</u>	<u>Features</u>	<u>1988</u>				<u>Year</u>
				<u>1st Qtr.</u>	<u>2nd Qtr.</u>	<u>3rd Qtr.</u>	<u>4th Qtr.</u>	
AMD	CMOS	150ns	x8	0	5	105	180	290
	CMOS	150ns	x16	30	50	70	90	240
Atmel	CMOS	70ns	x16	S	0	5	10	15
Fujitsu	CMOS		x8,x16	150	300	450	520	1,420
Hitachi	CMOS	110ns	x8,x16	300	300	275	225	1,100
Intel	NMOS		x8,x16	180	190	250	650	1,270
Mitsubishi	CMOS	120ns	x8,x16	100	300	450	750	1,600
	CMOS/OTP		x8,x16	N/A	S	40	80	120
NEC	CMOS		x8	280	160	370	420	1,230
	CMOS		x16	100	80	240	150	570
Okii	CMOS		x8,x16	0	0	0	0	0
SGS-Thomson	CMOS		x16	N/A	N/A	S	50	50
Sharp	CMOS		x8,x16	0	5	10	30	45
Toshiba	CMOS		x8	150	175	200	350	875
	CMOS	150ns	x16	N/A	S	5	10	15
	CMOS/OTP		x8	N/A	S	0	5	5
	CMOS/OTP		x16	20	20	50	100	190
	N			180	190	250	650	1,270
	C			<u>1,130</u>	<u>1,395</u>	<u>2,270</u>	<u>2,970</u>	<u>7,765</u>
Total				1,310	1,585	2,520	3,620	9,035
Percentage Change from Previous Quarter				37%	21%	59%	44%	
Cumulative Total				1,310	2,895	5,415	9,035	
ASPs:	NMOS			\$25.00	\$23.00	\$22.00	\$21.00	\$22.06
	CMOS			\$21.00	\$20.00	\$19.00	\$18.00	\$19.09
	Overall			\$21.55	\$20.36	\$19.30	\$18.54	\$19.51
Japan 1M spot 27.85 OEM 12.73								
Revenue (\$M)			28.2	32.3	48.6	67.1	176.2	

(Continued)

MOS EPROM--Data Update

Table 7 (Continued)

1-Mbit MOS EPROM Shipment Data

	Market Share				
	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Year
U.S.	16.0%	15.5%	17.1%	25.7%	20.1%
Japan	84.0	84.5	82.9	72.9	79.4
Europe	0	0	0	1.4	0.6
Total	100.0%	100.0%	100.0%	100.0%	100.0%

N/A = Not Available
S = Sampled

Source: Dataquest
May 1989

Table 8

2-Mbit MOS EPROM Shipment Data

Company	MOS Process	Technology Features	1988				Year
			1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
NEC	CMOS	x8 150ns	N/A	N/A	S	0	0
Total			0	0	0	0	0
Cumulative Total			0	0	0	0	
ASPs:	NMOS						0
	CMOS						0
	Overall						0
Revenue (\$M)			0	0	0	0	0

	Market Share				
	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Year
U.S.	0	0	0	0	0
Japan	0	0	0	0	0
Europe	0	0	0	0	0
Total	0	0	0	0	0

N/A = Not Available
S = Sampled

Source: Dataquest
May 1989

MOS EPROM--Data Update

Table 9

4-Mbit MOS EPROM Shipment Data

Company	MOS Process	Technology Features	1988				Year
			1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
Fujitsu	CMOS	x8	40	50	60	80	230
Intel	CMOS	x16 90ns	N/A	N/A	N/A	N/A	0
NEC	CMOS	x8 150ns	N/A	N/A	N/A	S	0
Toshiba	CMOS	x8 120ns	N/A	N/A	N/A	N/A	0
Total			40	50	60	80	230
Percentage Change from Previous Quarter			-	25%	20%	33%	
Cumulative Total			40	90	150	230	
ASPs:	CMOS		\$120.00	\$80.00	\$55.00	\$40.00	\$66.52
	Overall		\$120.00	\$80.00	\$55.00	\$40.00	\$66.52
Revenue (\$M)			4.8	4.0	3.3	3.2	15.3

	Market Share				Year
	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
U.S.	0	0	0	0	0
Japan	100.0%	100.0%	100.0%	100.0%	100.0%
Europe	0	0	0	0	0
Total	100.0%	100.0%	100.0%	100.0%	100.0%

N/A = Not Available
S = Sampled

Source: Dataquest
May 1989

MOS EPROM--Data

QUARTERLY COMPANY MOS EPROM SHIPMENT DATA

This section contains historical unit shipment data on MOS EPROMs from 1976 through 1987. In addition to unit shipments for 8K, 16K, 32K, 64K, 128K, 256K, 512K, and 1-Mbit EPROMs, we have added our estimates of the worldwide billing prices for each product during the four quarters of the year. At the bottom of each table, we show market share data (units, not revenue) for companies based in the United States, Japan, Europe, and Asia Pacific. The tables are organized as follows:

- Table 1--8K MOS EPROM Shipment Data, 1976-1985
- Table 2--16K MOS EPROM Shipment Data, 1976-1987
- Table 3--32K MOS EPROM Shipment Data, 1978-1987
- Table 4--64K MOS EPROM Shipment Data, 1980-1987
- Table 5--128K MOS EPROM Shipment Data, 1982-1987
- Table 6--256K MOS EPROM Shipment Data, 1983-1987
- Table 7--512K MOS EPROM Shipment Data, 1984-1987
- Table 8--1-Mbit MOS EPROM Shipment Data, 1986-1987

Definitions

Prices

Prices are Dataquest estimates of the billing prices during each quarter. These prices are averaged over all package types, lot sizes, and the entire speed mix, and they represent sales to both military and commercial accounts.

Quarterly Revenue

Quarterly revenue is calculated as units shipped times the prevailing price during that period.

MOS EPROM--Data

Table 1

8K MOS EPROM Shipment Data, 1976-1985

<u>Company</u>	<u>1976</u>				<u>Year</u>
	<u>1st</u> <u>Qtr.</u>	<u>2nd</u> <u>Qtr.</u>	<u>3rd</u> <u>Qtr.</u>	<u>4th</u> <u>Qtr.</u>	
AMD					
Electronic Arrays	N/A	N/A	N/A	S	S
Fairchild	N/A	N/A	N/A	N/A	N/A
Fujitsu	N/A	N/A	N/A	S	S
Intel	S	25	75	125	225
Mitsubishi	N/A	N/A	N/A	N/A	N/A
Motorola	N/A	N/A	N/A	N/A	N/A
National Semi.	N/A	N/A	N/A	N/A	N/A
Oki Electric	N/A	N/A	N/A	N/A	N/A
Texas Instruments	N/A	N/A	S	5	5
Toshiba	N/A	S	20	50	70
Total	S	25	95	180	300
Percentage Change from Previous Quarter	0	0	280%	89%	
Cumulative Total	0	25	120	300	
Average Selling Price	\$80.00	\$50.00	\$35.00	\$30.00	\$33.25
Revenue (\$M)	0	1.3	3.3	5.4	10.0
	<u>1976</u>				<u>Year</u>
	<u>1st</u> <u>Qtr.</u>	<u>2nd</u> <u>Qtr.</u>	<u>3rd</u> <u>Qtr.</u>	<u>4th</u> <u>Qtr.</u>	
Market Share					
U.S.	0	100.0%	78.9%	72.2%	76.7%
Japan	0	0	21.1	27.8	23.3
Europe	0	0	0	0	0
Total	0	100.0%	100.0%	100.0%	100.0%

N/A = Not Available
S = Sampling

(Continued)

MOS EPROM--Data

Table 1 (Continued)

8K MOS EPROM Shipment Data, 1976-1985

<u>Company</u>	<u>1977</u>				<u>Year</u>
	<u>1st</u> <u>Qtr.</u>	<u>2nd</u> <u>Qtr.</u>	<u>3rd</u> <u>Qtr.</u>	<u>4th</u> <u>Qtr.</u>	
AMD					
Electronic Arrays	10	15	50	75	150
Fairchild	0	0	0	5	5
Fujitsu	10	15	25	40	90
Intel	200	325	475	600	1,600
Mitsubishi	N/A	N/A	N/A	N/A	N/A
Motorola	S	15	20	35	70
National Semi.	S	25	40	85	150
Oki Electric	N/A	N/A	N/A	N/A	N/A
Texas Instruments	15	25	40	70	150
Toshiba	<u>100</u>	<u>100</u>	<u>200</u>	<u>300</u>	<u>700</u>
Total	335	520	850	1,210	2,915
Percentage Change from Previous Quarter	86%	55%	63%	42%	
Cumulative Total	635	1,155	2,005	3,215	
Average Selling Price	\$30.00	\$25.00	\$21.00	\$18.00	\$21.50
Revenue (\$M)	10.1	13.0	17.9	21.8	62.7
	<u>1977</u>				<u>Year</u>
	<u>1st</u> <u>Qtr.</u>	<u>2nd</u> <u>Qtr.</u>	<u>3rd</u> <u>Qtr.</u>	<u>4th</u> <u>Qtr.</u>	
Market Share					
U.S.	67.2%	77.9%	73.5%	71.9%	72.9%
Japan	32.8	22.1	26.5	28.1	27.1
Europe	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total	100.0%	100.0%	100.0%	100.0%	100.0%

N/A = Not Available
S = Sampling

(Continued)

MOS EPROM--Data

Table 1 (Continued)

8K MOS EPROM Shipment Data, 1976-1985

<u>Company</u>	<u>1978</u>				<u>Year</u>
	<u>1st</u> <u>Qtr.</u>	<u>2nd</u> <u>Qtr.</u>	<u>3rd</u> <u>Qtr.</u>	<u>4th</u> <u>Qtr.</u>	
AMD	15	50	80	340	485
Electronic Arrays	30	50	60	60	200
Fairchild	40	60	60	120	280
Fujitsu	50	90	70	70	280
Intel	700	900	800	1,000	3,400
Mitsubishi	50	125	175	250	600
Motorola	100	250	250	420	1,020
National Semi.	275	260	310	405	1,250
Oki Electric	N/A	N/A	N/A	N/A	N/A
Texas Instruments	350	550	400	800	2,100
Toshiba	<u>N/A</u>	<u>N/A</u>	<u>10</u>	<u>30</u>	<u>40</u>
Total	1,610	2,335	2,215	3,495	9,655
Percentage Change from Previous Quarter	33%	45%	(5%)	58%	
Cumulative Total	4,825	7,160	9,375	12,870	
Average Selling Price	\$15.00	\$9.00	\$5.00	\$4.50	\$7.45
Revenue (\$M)	24.2	21.0	11.1	15.7	72.0
	<u>1978</u>				<u>Year</u>
	<u>1st</u> <u>Qtr.</u>	<u>2nd</u> <u>Qtr.</u>	<u>3rd</u> <u>Qtr.</u>	<u>4th</u> <u>Qtr.</u>	
Market Share					
U.S.	93.8%	90.8%	88.5%	90.0%	90.5%
Japan	6.2	9.2	11.5	10.0	9.5
Europe	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total	100.0%	100.0%	100.0%	100.0%	100.0%

N/A = Not Available

(Continued)

MOS EPROM--Data

Table 1 (Continued)

8K MOS EPROM Shipment Data, 1976-1985

<u>Company</u>	<u>1979</u>				<u>Year</u>
	<u>1st</u> <u>Qtr.</u>	<u>2nd</u> <u>Qtr.</u>	<u>3rd</u> <u>Qtr.</u>	<u>4th</u> <u>Qtr.</u>	
AMD	600	700	700	500	2,500
Electronic Arrays	75	100	125	35	335
Fairchild	160	200	350	600	1,310
Fujitsu	70	50	50	50	220
Intel	1,100	1,400	1,400	1,100	5,000
Mitsubishi	190	240	240	270	940
Motorola	700	750	1,000	1,000	3,450
National Semi.	600	800	800	900	3,100
Oki Electric	N/A	N/A	N/A	N/A	N/A
Texas Instruments	800	800	800	800	3,200
Toshiba	<u>50</u>	<u>100</u>	<u>100</u>	<u>50</u>	<u>300</u>
Total	4,345	5,140	5,565	5,305	20,355

Percentage Change from
Previous Quarter

24% 18% 8% (5%)

Cumulative Total

17,215 22,355 27,920 33,225

Average Selling Price

\$6.00 \$8.00 \$7.00 \$5.50 \$6.65

Revenue (\$M)

26.1 41.1 39.0 29.2 135.3

	<u>1979</u>				<u>Year</u>
	<u>1st</u> <u>Qtr.</u>	<u>2nd</u> <u>Qtr.</u>	<u>3rd</u> <u>Qtr.</u>	<u>4th</u> <u>Qtr.</u>	
Market Share					
U.S.	92.9%	92.4%	93.0%	93.0%	92.8%
Japan	7.1	7.6	7.0	7.0	7.2
Europe	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total	100.0%	100.0%	100.0%	100.0%	100.0%

N/A = Not Available

(Continued)

MOS EPROM--Data

Table 1 (Continued)

8K MOS EPROM Shipment Data, 1976-1985

Company	1980				Year
	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	600	700	650	350	2,300
Electronic Arrays	0	0	0	0	0
Fairchild	750	1,000	850	600	3,200
Fujitsu	50	50	50	50	200
Intel	700	500	500	250	1,950
Mitsubishi	160	60	90	80	390
Motorola	500	500	350	250	1,600
National Semi.	1,000	1,000	700	600	3,300
Oki Electric	N/A	N/A	N/A	S	N/A
Texas Instruments	800	600	600	580	2,580
Toshiba	35	0	0	0	35
Total	4,595	4,410	3,790	2,760	15,555
Percentage Change from Previous Quarter	(13%)	(4%)	(14%)	(27%)	
Cumulative Total	37,820	42,230	46,020	48,780	
Average Selling Price	\$5.00	\$4.50	\$4.50	\$3.00	\$4.38
Revenue (\$M)	23.0	19.8	17.1	8.3	68.2
	1980				Year
	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
Market Share					
U.S.	94.7%	97.5%	96.3%	95.3%	96.0%
Japan	5.3	2.5	3.7	4.7	4.0
Europe	0	0	0	0	0
Total	100.0%	100.0%	100.0%	100.0%	100.0%

N/A = Not Available

S = Sampling

(Continued)

MOS EPROM--Data

Table 1 (Continued)
8K MOS EPROM Shipment Data, 1976-1985

<u>Company</u>	<u>1981</u>				<u>Year</u>
	<u>1st</u> <u>Qtr.</u>	<u>2nd</u> <u>Qtr.</u>	<u>3rd</u> <u>Qtr.</u>	<u>4th</u> <u>Qtr.</u>	
AMD	500	200	200	190	1,090
Electronic Arrays	0	0	0	0	0
Fairchild	300	240	150	50	740
Fujitsu	50	20	10	0	80
Intel	200	150	100	50	500
Mitsubishi	110	40	30	25	205
Motorola	150	175	150	220	695
National Semi.	400	350	200	100	1,050
Oki Electric	50	50	70	50	220
Texas Instruments	550	400	300	200	1,450
Toshiba	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total	2,310	1,625	1,210	885	6,030
Percentage Change from Previous Quarter	(16%)	(30%)	(26%)	(27%)	
Cumulative Total	51,090	52,715	53,925	54,810	
Average Selling Price	\$3.50	\$3.00	\$2.50	\$2.00	\$2.94
Revenue (\$M)	8.1	4.9	3.0	1.8	17.8
	<u>1981</u>				<u>Year</u>
	<u>1st</u> <u>Qtr.</u>	<u>2nd</u> <u>Qtr.</u>	<u>3rd</u> <u>Qtr.</u>	<u>4th</u> <u>Qtr.</u>	
Market Share					
U.S.	90.9%	93.2%	90.9%	91.5%	91.6%
Japan	9.1	6.8	9.1	8.5	8.4
Europe	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total	100.0%	100.0%	100.0%	100.0%	100.0%

(Continued)

MOS EPROM--Data

Table 1 (Continued)

8K MOS EPROM Shipment Data, 1976-1985

<u>Company</u>	<u>1982</u>				<u>Year</u>
	<u>1st</u> <u>Qtr.</u>	<u>2nd</u> <u>Qtr.</u>	<u>3rd</u> <u>Qtr.</u>	<u>4th</u> <u>Qtr.</u>	
AMD	180	100	100	50	430
Electronic Arrays	0	0	0	0	0
Fairchild	30	5	0	0	35
Fujitsu	0	0	0	0	0
Intel	15	5	0	0	20
Mitsubishi	20	15	30	0	65
Motorola	200	160	250	150	760
National Semi.	70	50	50	50	220
Oki Electric	30	25	15	25	95
Texas Instruments	100	70	35	25	230
Toshiba	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total	645	430	480	300	1,855
Percentage Change from Previous Quarter	(27%)	(33%)	12%	(38%)	
Cumulative Total	55,455	55,885	56,365	56,665	
Average Selling Price	\$3.50	\$3.50	\$3.25	\$3.25	\$3.39
Revenue (\$M)	2.3	1.5	1.6	1.0	6.3
	<u>1982</u>				<u>Year</u>
	<u>1st</u> <u>Qtr.</u>	<u>2nd</u> <u>Qtr.</u>	<u>3rd</u> <u>Qtr.</u>	<u>4th</u> <u>Qtr.</u>	
Market Share					
U.S.	92.2%	90.7%	90.6%	91.7%	91.4%
Japan	7.8	9.3	9.4	8.3	8.6
Europe	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total	100.0%	100.0%	100.0%	100.0%	100.0%

(Continued)

MOS EPROM--Data

Table 1 (Continued)
8K MOS EPROM Shipment Data, 1976-1985

<u>Company</u>	<u>1983</u>				<u>Year</u>
	<u>1st</u> <u>Qtr.</u>	<u>2nd</u> <u>Qtr.</u>	<u>3rd</u> <u>Qtr.</u>	<u>4th</u> <u>Qtr.</u>	
AMD	100	100	50	50	300
Electronic Arrays	0	0	0	0	0
Fairchild	0	0	0	0	0
Fujitsu	0	0	0	0	0
Intel	0	0	0	0	0
Mitsubishi	0	0	0	0	0
Motorola	120	100	70	0	290
National Semi.	50	50	25	25	150
Oki Electric	0	0	0	0	0
Texas Instruments	0	0	0	0	0
Toshiba	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total	270	250	145	75	740
Percentage Change from Previous Quarter	(10%)	(7%)	(42%)	(48%)	
Cumulative Total	56,935	57,185	57,330	57,405	
Average Selling Price	\$3.50	\$4.00	\$4.00	\$4.25	\$3.84
Revenue (\$M)	0.9	1.0	0.6	0.3	2.8
	<u>1983</u>				<u>Year</u>
	<u>1st</u> <u>Qtr.</u>	<u>2nd</u> <u>Qtr.</u>	<u>3rd</u> <u>Qtr.</u>	<u>4th</u> <u>Qtr.</u>	
Market Share					
U.S.	100.0%	100.0%	100.0%	100.0%	100.0%
Japan	0	0	0	0	0
Europe	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total	100.0%	100.0%	100.0%	100.0%	100.0%

(Continued)

MOS EPROM--Data

Table 1 (Continued)
8K MOS EPROM Shipment Data, 1976-1985

<u>Company</u>	<u>1984</u>				<u>Year</u>
	<u>1st</u> <u>Qtr.</u>	<u>2nd</u> <u>Qtr.</u>	<u>3rd</u> <u>Qtr.</u>	<u>4th</u> <u>Qtr.</u>	
AMD	80	130	30	20	260
Electronic Arrays	0	0	0	0	0
Fairchild	0	0	0	0	0
Fujitsu	0	0	0	0	0
Intel	0	0	0	0	0
Mitsubishi	0	0	0	0	0
Motorola	0	0	0	0	0
National Semi.	25	0	0	0	25
Oki Electric	0	0	0	0	0
Texas Instruments	0	0	0	0	0
Toshiba	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total	105	130	30	20	285
Percentage Change from Previous Quarter	40%	24%	(77%)	(33%)	
Cumulative Total	57,510	57,640	57,670	57,690	
Average Selling Price	\$4.00	\$4.00	\$4.00	\$5.00	\$4.07
Revenue (\$M)	0.4	0.5	0.1	0.1	1.2
	<u>1984</u>				<u>Year</u>
	<u>1st</u> <u>Qtr.</u>	<u>2nd</u> <u>Qtr.</u>	<u>3rd</u> <u>Qtr.</u>	<u>4th</u> <u>Qtr.</u>	
Market Share					
U.S.	100.0%	100.0%	100.0%	100.0%	100.0%
Japan	0	0	0	0	0
Europe	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total	100.0%	100.0%	100.0%	100.0%	100.0%

(Continued)

MOS EPROM--Data

Table 1 (Continued)
8K MOS EPROM Shipment Data, 1976-1985

<u>Company</u>	<u>1985</u>				<u>Year</u>
	<u>1st</u> <u>Qtr.</u>	<u>2nd</u> <u>Qtr.</u>	<u>3rd</u> <u>Qtr.</u>	<u>4th</u> <u>Qtr.</u>	
AMD	15	10	5	5	35
Electronic Arrays	0	0	0	0	0
Fairchild	0	0	0	0	0
Fujitsu	0	0	0	0	0
Intel	0	0	0	0	0
Mitsubishi	0	0	0	0	0
Motorola	0	0	0	0	0
National Semi.	0	0	0	0	0
Oki Electric	0	0	0	0	0
Texas Instruments	0	0	0	0	0
Toshiba	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total	15	10	5	5	35
Percentage Change from Previous Quarter	(25%)	(33%)	(50%)	0	
Cumulative Total	57,705	57,715	57,720	57,725	
Average Selling Price	\$5.50	\$6.00	\$7.00	\$8.00	\$6.21
Revenue (\$M)	0.1	0.1	0	0	0.2
	<u>1985</u>				<u>Year</u>
	<u>1st</u> <u>Qtr.</u>	<u>2nd</u> <u>Qtr.</u>	<u>3rd</u> <u>Qtr.</u>	<u>4th</u> <u>Qtr.</u>	
Market Share					
U.S.	100.0%	100.0%	100.0%	100.0%	100.0%
Japan	0	0	0	0	0
Europe	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total	100.0%	100.0%	100.0%	100.0%	100.0%

Source: Dataquest
May 1989

MOS EPROM--Data

Table 2

16K MOS EPROM Shipment Data, 1976-1987

Company	MOS Process	1976				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	N/A	N/A	N/A	N/A	N/A
Eurotechnique	C	N/A	N/A	N/A	N/A	N/A
Fairchild	N	N/A	N/A	N/A	N/A	N/A
Fujitsu	N	N/A	N/A	N/A	N/A	N/A
Hitachi	N	N/A	N/A	N/A	N/A	N/A
Intel	N	N/A	N/A	S	10	10
Matsushita	N	N/A	N/A	N/A	N/A	N/A
Mitsubishi	N	N/A	N/A	N/A	N/A	N/A
Mostek	N	N/A	N/A	N/A	N/A	N/A
Motorola	N	N/A	N/A	N/A	N/A	N/A
National Semi.	N	N/A	N/A	N/A	N/A	N/A
NEC	C	N/A	N/A	N/A	N/A	N/A
Oki Electric	N	N/A	N/A	N/A	N/A	N/A
SGS-Ates	N	N/A	N/A	N/A	N/A	N/A
Synertek	N	N/A	N/A	N/A	N/A	N/A
Texas Instruments	N	N/A	N/A	N/A	5	5
Toshiba	N	N/A	N/A	N/A	N/A	N/A
	N	0	0	0	15	15
	C	0	0	0	0	0
Total		0	0	0	15	15
Percentage Change from Previous Quarter						
Cumulative Total		0	0	0	15	
ASPs:						
NMOS		\$50.00	\$50.00	\$50.00	\$50.00	\$50.00
CMOS		0	0	0	0	0
Overall		\$50.00	\$50.00	\$50.00	\$50.00	\$50.00
Revenue (\$M)		0	0	0	0.8	0.8
Market Share						
U.S.		0	0	0	100.0%	100.0%
Japan		0	0	0	0	0
Europe		0	0	0	0	0
Total		0	0	0	100.0%	100.0%

S = Sampling
N/A = Not Available

(Continued)

MOS EPROM--Data

Table 2 (Continued)

16K MOS EPROM Shipment Data, 1976-1987

Company	MOS Process	1977				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	N/A	N/A	N/A	N/A	N/A
Eurotechnique	C	N/A	N/A	N/A	N/A	N/A
Fairchild	N	N/A	N/A	N/A	N/A	N/A
Fujitsu	N	N/A	N/A	N/A	N/A	N/A
Hitachi	N	N/A	N/A	N/A	N/A	N/A
Intel	N	40	75	100	125	340
Matsushita	N	N/A	N/A	N/A	N/A	N/A
Mitsubishi	N	N/A	N/A	N/A	N/A	N/A
Mostek	N	N/A	N/A	N/A	N/A	N/A
Motorola	N	N/A	N/A	N/A	N/A	N/A
National Semi.	N	N/A	N/A	N/A	N/A	N/A
	C	N/A	N/A	N/A	N/A	N/A
NEC	N	N/A	N/A	N/A	N/A	N/A
Oki Electric	N	N/A	N/A	N/A	N/A	N/A
SGS-Ates	N	N/A	N/A	N/A	N/A	N/A
Synertek	N	N/A	N/A	N/A	N/A	N/A
Texas Instruments	N	20	25	30	55	130
Toshiba	N	N/A	N/A	N/A	N/A	N/A
	N	60	100	130	180	470
	C	0	0	0	0	0
Total		60	100	130	180	470
Percentage Change from Previous Quarter						
		0	67%	30%	38%	
Cumulative Total						
		75	175	305	485	
ASPs: NMOS						
		\$45.00	\$45.00	\$30.00	\$30.00	\$35.11
CMOS						
		0	0	0	0	0
Overall						
		\$45.00	\$45.00	\$30.00	\$30.00	\$35.11
Revenue (\$M)						
		2.7	4.5	3.9	5.4	16.5
Market Share						
U.S.		100.0%	100.0%	100.0%	100.0%	100.0%
Japan		0	0	0	0	0
Europe		0	0	0	0	0
Total		100.0%	100.0%	100.0%	100.0%	100.0%

N/A = Not Available

(Continued)

MOS EPROM--Data

Table 2 (Continued)

16K MOS EPROM Shipment Data, 1976-1987

Company	MOS Process	1978				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	N/A	N/A	N/A	N/A	0
Eurotechnique	C	N/A	N/A	N/A	N/A	0
Fairchild	N	N/A	N/A	N/A	N/A	0
Fujitsu	N	N/A	N/A	N/A	5	5
Hitachi	N	N/A	N/A	5	30	35
Intel	N	250	400	250	450	1,350
Matsushita	N	N/A	N/A	N/A	N/A	0
Mitsubishi	N	N/A	N/A	N/A	N/A	0
Mostek	N	S	S	S	25	25
Motorola	N	N/A	S	10	90	100
National Semi.	N	N/A	N/A	S	S	0
	C	N/A	N/A	N/A	N/A	0
NEC	N	N/A	N/A	N/A	N/A	0
Oki Electric	N	N/A	N/A	N/A	N/A	0
SGS-Ates	N	N/A	N/A	N/A	N/A	0
Synertek	N	N/A	N/A	N/A	N/A	0
Texas Instruments	N	100	250	200	300	850
Toshiba	N	N/A	N/A	S	5	5
	N	350	650	465	905	2,370
	C	0	0	0	0	0
Total		350	650	465	905	2,370
Percentage Change from Previous Quarter		94%	86%	(28%)	95%	
Cumulative Total		835	1,485	1,950	2,855	
ASPs: NMOS		\$28.00	\$25.00	\$25.00	\$15.00	\$21.62
CMOS		0	0	0	0	0
Overall		\$28.00	\$25.00	\$25.00	\$15.00	\$21.62
Revenue (\$M)		9.8	16.3	11.6	13.6	51.3
		1978				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
Market Share						
U.S.		100.0%	100.0%	98.9%	95.6%	98.1%
Japan		0	0	1.1	4.4	1.9
Europe		0	0	0	0	0
Total		100.0%	100.0%	100.0%	100.0%	100.0%

S = Sampling
N/A = Not Available

(Continued)

MOS EPROM--Data

Table 2 (Continued)

16K MOS EPROM Shipment Data, 1976-1987

Company	MOS Process	1979				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	N/A	S	5	10	15
Eurotechnique	C	N/A	N/A	N/A	N/A	0
Fairchild	N	N/A	N/A	N/A	N/A	0
Fujitsu	N	70	200	300	300	870
Hitachi	N	125	200	350	500	1,175
Intel	N	550	750	800	900	3,000
Matsushita	N	N/A	N/A	N/A	N/A	0
Mitsubishi	N	10	20	50	90	170
Mostek	N	90	150	250	350	840
Motorola	N	160	150	160	200	670
National Semi.	N	5	50	80	120	255
	C	N/A	N/A	N/A	N/A	0
NEC	N	N/A	N/A	N/A	5	5
Oki Electric	N	N/A	N/A	N/A	N/A	0
SGS-Ates	N	N/A	N/A	N/A	N/A	0
Synertek	N	N/A	N/A	N/A	S	0
Texas Instruments	N	400	900	1,100	1,800	4,200
Toshiba	N	25	50	90	200	365
	N	1,435	2,470	3,185	4,475	11,565
	C	0	0	0	0	0
Total		1,435	2,470	3,185	4,475	11,565
Percentage Change from Previous Quarter						
		59%	72%	29%	41%	
Cumulative Total						
		4,290	6,760	9,945	14,420	
ASPs: NMOS						
		\$17.00	\$22.00	\$19.00	\$17.00	\$18.62
CMOS						
		0	0	0	0	0
Overall						
		\$17.00	\$22.00	\$19.00	\$17.00	\$18.62
Revenue (\$M)						
		24.4	54.3	60.5	76.1	215.3
Market Share						
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Year
U.S.		84.0%	81.0%	75.2%	75.5%	77.6%
Japan		16.0	19.0	24.8	24.5	22.4
Europe		0	0	0	0	0
Total		100.0%	100.0%	100.0%	100.0%	100.0%

S = Sampling
N/A = Not Available

(Continued)

MOS EPROM--Data

Table 2 (Continued)

16K MOS EPROM Shipment Data, 1976-1987

Company	MOS Process	1980				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	25	50	100	175	350
Eurotechnique	C	N/A	N/A	N/A	N/A	0
Fairchild	N	30	300	300	250	880
Fujitsu	N	350	750	700	650	2,450
Hitachi	N	700	850	1,025	1,325	3,900
Intel	N	950	1,000	1,700	1,850	5,500
Matsushita	N	S	50	50	80	180
Mitsubishi	N	210	260	270	410	1,150
Mostek	N	275	250	350	450	1,325
Motorola	N	250	350	500	500	1,600
National Semi.	N	250	250	300	425	1,225
	C	N/A	N/A	N/A	N/A	0
NEC	N	10	25	50	125	210
Oki Electric	N	S	0	0	0	0
SGS-Ates	N	1,800	0	0	5	1,805
Synertek	N	200	25	10	0	235
Texas Instruments	N	2,000	2,000	2,000	2,100	8,100
Toshiba	N	300	330	350	400	1,380
	N	7,350	6,490	7,705	8,745	30,290
	C	0	0	0	0	0
Total		7,350	6,490	7,705	8,745	30,290
Percentage Change from Previous Quarter						
		64%	(12%)	19%	13%	
Cumulative Total		21,770	28,260	35,965	44,710	
ASPs:						
NMOS		\$15.00	\$11.00	\$8.00	\$6.00	\$9.76
CMOS		0	0	0	0	0
Overall		\$15.00	\$11.00	\$8.00	\$6.00	\$9.76
Revenue (\$M)		110.3	71.4	61.6	52.5	295.8
Market Share						
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Year
U.S.		54.1%	65.1%	68.3%	65.8%	63.4%
Japan		21.4	34.9	31.7	34.2	30.6
Europe		24.5	0	0	0.1	6.0
Total		100.0%	100.0%	100.0%	100.0%	100.0%

S = Sampling

N/A = Not Available

Note: Columns may not add to totals shown because of rounding.

(Continued)

MOS EPROM--Data

Table 2 (Continued)

16K MOS EPROM Shipment Data, 1976-1987

Company	MOS Process	1981				
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Year
AMD	N	250	350	485	750	1,835
Eurotechnique	C	N/A	N/A	S	15	15
Fairchild	N	100	20	20	0	140
Fujitsu	N	750	1,000	700	500	2,950
Hitachi	N	1,700	1,700	1,200	700	5,300
Intel	N	2,600	3,000	3,000	3,000	11,600
Matsushita	N	120	150	200	250	720
Mitsubishi	N	580	740	670	520	2,510
Mostek	N	700	600	700	800	2,800
Motorola	N	400	420	500	400	1,720
National Semi.	N	500	550	700	1,100	2,850
NEC	C	N/A	N/A	N/A	N/A	N/A
Oki Electric	N	175	250	600	900	1,925
SGS-Ates	N	25	40	80	100	245
SGS-Ates	N	15	25	50	75	165
Synertek	N	0	0	0	0	0
Texas Instruments	N	2,200	2,500	2,200	2,200	9,100
Toshiba	N	90	100	200	350	740
	N	10,205	11,445	11,305	11,645	44,600
	C	0	0	0	15	15
Total		10,205	11,445	11,305	11,660	44,615
Percentage Change from Previous Quarter						
		17%	12%	(1%)	3%	
Cumulative Total		54,915	66,360	77,665	89,325	
ASPs:						
NMOS		\$4.50	\$3.50	\$3.00	\$2.50	\$3.34
CMOS		0	0	0	0	0
Overall		\$4.50	\$3.50	\$3.00	\$2.50	\$3.34
Revenue (\$M)		45.9	40.1	33.9	29.1	149.0
Market Share						
U.S.		66.1%	65.0%	67.3%	70.8%	67.3%
Japan		33.7	34.8	32.3	28.5	32.3
Europe		0.1	0.2	0.4	0.8	0.4
Total		100.0%	100.0%	100.0%	100.0%	100.0%

S - Sampling

N/A = Not Available

Note: Columns may not add to totals shown because of rounding.

(Continued)

MOS EPROM--Data

Table 2 (Continued)

16K MOS EPROM Shipment Data, 1976-1987

Company	MOS Process	1982				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	1,000	1,150	1,150	900	4,200
Eurotechnique	C	100	400	500	600	1,600
Fairchild	N	0	0	0	0	0
Fujitsu	N	400	350	250	100	1,100
Hitachi	N	450	250	200	200	1,100
Intel	N	3,000	2,500	1,800	1,200	8,500
Matsushita	N	250	250	150	100	750
Mitsubishi	N	450	350	300	160	1,260
Mostek	N	500	200	250	250	1,200
Motorola	N	250	160	100	60	570
National Semi.	N	1,200	1,250	1,300	2,200	5,950
	C	50	150	200	200	600
NEC	N	900	1,000	1,200	1,200	4,300
Oki Electric	N	250	400	400	400	1,450
SGS-Ates	N	100	180	350	520	1,150
Synertek	N	0	0	0	0	0
Texas Instruments	N	2,000	2,000	1,800	1,800	7,600
Toshiba	N	500	400	300	300	1,500
	N	11,250	10,440	9,550	9,390	40,630
	C	150	550	700	800	2,200
Total		11,400	10,990	10,250	10,190	42,830
Percentage Change from Previous Quarter						
		(2%)	(4%)	(7%)	(1%)	
Cumulative Total		100,725	111,715	121,965	132,155	
ASPs: NMOS		\$3.25	\$3.10	\$3.00	\$3.00	\$3.09
CMOS		0	0	0	0	0
Overall		\$3.25	\$3.10	\$3.00	\$3.00	\$3.09
Revenue (\$M)		36.6	32.4	28.7	28.2	125.7
Market Share						
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Year
U.S.		70.2%	67.4%	64.4%	64.9%	66.8%
Japan		28.1	27.3	27.3	24.1	26.8
Europe		1.8	5.3	8.3	11.0	6.4
Total		100.0%	100.0%	100.0%	100.0%	100.0%

Note: Columns may not add to totals shown because of rounding.

(Continued)

MOS EPROM--Data

Table 2 (Continued)

16K MOS EPROM Shipment Data, 1976-1987

Company	MOS Process	1983				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	700	700	1,000	1,200	3,600
Eurotechnique	C	200	200	200	200	800
Fairchild	N	0	0	0	0	0
Fujitsu	N	50	50	0	0	100
Hitachi	N	100	100	50	0	250
Intel	N	1,000	1,000	800	700	3,500
Matsushita	N	100	100	100	100	400
Mitsubishi	N	180	120	160	130	590
Mostek	N	200	150	150	50	550
Motorola	N	50	80	30	0	160
National Semi.	N	2,150	2,500	2,500	2,800	9,950
	C	350	500	500	700	2,050
NEC	N	2,000	2,500	2,700	1,500	8,700
Oki Electric	N	400	400	350	350	1,500
SGS-Ates	N	500	800	800	900	3,000
Synertek	N	0	0	0	0	0
Texas Instruments	N	2,000	2,500	3,000	3,000	10,500
Toshiba	N	200	100	100	100	500
	N	9,630	11,100	11,740	10,830	43,300
	C	550	700	700	900	2,850
Total		10,180	11,800	12,440	11,730	46,150
Percentage Change from Previous Quarter						
		0%	16%	5%	(6%)	
Cumulative Total		142,335	154,135	166,575	178,305	
ASPs:	NMOS	\$3.00	\$3.15	\$3.25	\$3.35	\$3.19
	CMOS	0	0	0	0	0
	Overall	\$3.00	\$3.15	\$3.25	\$3.35	\$3.19
Revenue (\$M)		28.9	35.0	38.2	36.3	138.3
Market Share						
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Year
U.S.		63.4%	63.0%	64.1%	72.0%	65.7%
Japan		29.8	28.6	27.8	18.6	26.1
Europe		6.9	8.5	8.0	9.4	8.2
Total		100.0%	100.0%	100.0%	100.0%	100.0%

Note: Columns may not add to totals shown because of rounding.

(Continued)

MOS EPROM--Data

Table 2 (Continued)

16K MOS EPROM Shipment Data, 1976-1987

Company	MOS Process	1984				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	1,000	1,100	1,200	1,300	4,600
Fairchild	N	0	0	0	0	0
Fujitsu	N	0	0	0	0	0
Hitachi	N	0	0	0	0	0
Intel	N	300	150	100	50	600
Matsushita	N	50	50	25	0	125
Mitsubishi	N	130	130	130	100	490
Mostek	N	0	0	0	0	0
Motorola	N	0	0	0	0	0
National Semi.	N	2,800	2,700	2,400	2,000	9,900
	C	700	700	550	400	2,350
NEC	N	1,350	1,200	950	700	4,200
Oki Electric	N	250	250	200	200	900
SGS	N	1,050	600	300	800	2,750
Synertek	N	0	0	0	0	0
Texas Instruments	N	3,500	3,000	2,000	1,800	10,300
Thomson-Eurotechnique	C	200	250	250	250	950
Toshiba	N	0	0	0	0	0
	N	10,430	9,180	7,305	6,950	33,865
	C	900	950	800	650	3,300
Total		11,330	10,130	8,105	7,600	37,165
Percentage Change from Previous Quarter						
		(3%)	(11%)	(20%)	(6%)	
Cumulative Total		189,635	199,765	207,870	215,470	
ASPs: NMOS		\$3.35	\$3.35	\$3.00	\$2.85	\$3.17
CMOS		\$5.50	\$5.50	\$5.25	\$4.50	\$5.24
Overall		\$3.52	\$3.55	\$3.22	\$2.99	\$3.36
Revenue (\$M)		39.9	36.0	26.1	22.7	124.7
Market Share						
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Year
U.S.		73.3%	75.5%	77.1%	73.0%	74.7%
Japan		15.7	16.1	16.1	13.2	15.4
Europe		11.0	8.4	6.8	13.8	10.0
Total		100.0%	100.0%	100.0%	100.0%	100.0%

Note: Columns may not add to totals shown because of rounding.

(Continued)

MOS EPROM--Data

Table 2 (Continued)

16K MOS EPROM Shipment Data, 1976-1987

Company	MOS Process	1985				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	1,550	1,850	1,350	1,050	5,800
Fairchild	N	0	0	0	0	0
Fujitsu	N	0	0	0	0	0
Hitachi	N	0	0	0	0	0
Intel	N	0	0	0	0	0
Matsushita	N	0	0	0	0	0
Mitsubishi	N	50	50	0	0	100
Mostek	N	0	0	0	0	0
Motorola	N	0	0	0	0	0
National Semi.	N	1,800	1,600	1,500	1,200	6,100
	C	400	350	400	500	1,650
NEC	N	400	250	800	270	1,720
Oki Electric	N	150	150	100	100	500
SGS	N	750	800	1,100	1,200	3,850
Synertek	N	0	0	0	0	0
Texas Instruments	N	1,500	1,500	1,600	1,600	6,200
Thomson-Eurotechnique	C	350	450	400	500	1,700
Toshiba	N	0	0	0	0	0
	N	6,200	6,200	6,450	5,420	24,270
	C	750	800	800	1,000	3,350
Total		6,950	7,000	7,250	6,420	27,620
Percentage Change from Previous Quarter						
		(9%)	1%	4%	(11%)	
Cumulative Total		222,420	229,420	236,670	243,090	
ASPs:						
NMOS		\$2.60	\$2.40	\$2.25	\$2.25	\$2.38
CMOS		\$4.00	\$3.50	\$3.25	\$3.25	\$3.48
Overall		\$2.75	\$2.53	\$2.36	\$2.41	\$2.51
Revenue (\$M)		19.1	17.7	17.1	15.4	69.4
Market Share						
U.S.		75.5%	75.7%	66.9%	67.8%	71.5%
Japan		8.6	6.4	12.4	5.8	8.4
Europe		15.8	17.9	20.7	26.5	20.1
Total		100.0%	100.0%	100.0%	100.0%	100.0%

Note: Columns may not add to totals shown because of rounding.

(Continued)

MOS EPROM--Data

Table 2 (Continued)

16K MOS EPROM Shipment Data, 1976-1987

Company	MOS Process	1986				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	1,000	600	450	375	2,425
Intel	N	250	250	250	250	1,000
National Semi.	N	1,500	1,200	950	800	4,450
NEC	N	180	220	80	40	520
SGS	N	356	189	600	400	1,545
Texas Instruments	N	750	750	400	200	2,100
Thomson	N	1,000	600	600	425	2,625
	N	5,036	3,809	3,330	2,490	14,665
	C	0	0	0	0	0
Total		5,036	3,809	3,330	2,490	14,665
Percentage Change from Previous Quarter		(22%)	(24%)	(13%)	(25%)	
Cumulative Total		248,126	251,935	255,265	257,755	
ASPs:	NMOS	\$2.35	\$2.40	\$2.40	\$2.50	\$2.40
	CMOS	0	0	0	0	0
	Overall	\$2.35	\$2.40	\$2.40	\$2.50	\$2.40
Revenue (\$M)		11.8	9.1	8.0	6.2	35.2
		1986				
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Year
Market Share						
U.S.		69.5%	73.5%	61.6%	65.3%	68.0%
Japan		3.6	5.8	2.4	1.6	3.5
Europe		26.9	20.7	36.0	33.1	28.4
Total		100.0%	100.0%	100.0%	100.0%	100.0%

Note: Columns may not add to totals shown because of rounding.

(Continued)

MOS EPROM--Data

Table 2 (Continued)

16K MOS EPROM Shipment Data, 1976-1987

Company	MOS Process	1987				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	500	300	300	290	1,390
Cypress	C	150	200	200	350	900
Intel	N	200	200	200	200	800
National Semi.	C	158	227	204	195	784
NEC	N	40	40	50	30	160
SGS-Thomson	N	1,185	1,125	1,240	720	4,270
	C	15	70	30	75	190
Texas Instruments	N	200	200	150	150	700
	C	50	50	110	125	335
WaferScale	C	10	25	75	75	185
	N	2,125	1,865	1,940	1,390	7,320
	C	383	572	619	820	2,394
Total		2,508	2,437	2,559	2,210	9,714
Percentage Change from Previous Quarter		1%	(3%)	5%	(14%)	
Cumulative Total		260,263	262,700	265,259	267,469	
ASPs:	NMOS	\$2.55	\$2.60	\$2.65	\$2.70	\$2.62
	CMOS	\$4.60	\$2.90	\$3.10	\$3.30	\$3.36
	Overall	\$2.86	\$2.67	\$2.76	\$2.92	\$2.80
Revenue (\$M)		7.2	6.5	7.1	6.5	27.2
		1987				
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Year
Market Share						
U.S.		50.6%	49.3%	48.4%	62.7%	52.4%
Japan		1.6	1.6	2.0	1.3	1.6
Europe		47.8	49.0	49.6	36.0	45.9
Total		100.0%	100.0%	100.0%	100.0%	100.0%

Note: Columns may not add to totals shown because of rounding.

Source: Dataquest
May 1989

MOS EPROM--Data

Table 3

32K MOS EPROM Shipment Data, 1978-1987

Company	MOS Process	1978				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	N/A	N/A	N/A	N/A	0
Eurotechnique	C	N/A	N/A	N/A	N/A	0
Fujitsu	N	N/A	N/A	N/A	N/A	0
	C	N/A	N/A	N/A	N/A	0
Hitachi	N	N/A	N/A	N/A	N/A	0
Intel	N	N/A	N/A	N/A	S	0
Mitsubishi	N	N/A	N/A	N/A	N/A	0
Motorola	N	N/A	N/A	N/A	N/A	0
National Semi.	C	N/A	N/A	N/A	N/A	0
NEC	N	N/A	N/A	N/A	N/A	0
Ricoh	C	N/A	N/A	N/A	N/A	0
Rockwell	N	N/A	N/A	N/A	N/A	0
	C	N/A	N/A	N/A	N/A	0
SGS-Ates	N	N/A	N/A	N/A	N/A	0
Texas Instruments	N	N/A	N/A	N/A	5	5
Toshiba	N	N/A	N/A	N/A	N/A	0
	N	0	0	0	5	5
	C	0	0	0	0	0
Total		0	0	0	5	5
Percentage Change from Previous Quarter		0	0	0	0	
Cumulative Total		0	0	0	5	
ASPs: NMOS		0	0	0	0	\$80.00
CMOS		0	0	0	0	0
Overall		0	0	0	0	\$80.00
Revenue (\$M)		0	0	0	0	0
		1978				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
Market Share						
U.S.		0	0	0	0	0
Japan		0	0	0	0	0
Europe		0	0	0	0	0
Total		0	0	0	0	0

S = Sampling
N/A = Not Available

(Continued)

MOS EPROM--Data

Table 3 (Continued)

32K MOS EPROM Shipment Data, 1978-1987

Company	MOS Process	1979				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	N/A	N/A	N/A	N/A	0
Eurotechnique	C	N/A	N/A	N/A	N/A	0
Fujitsu	N	N/A	N/A	N/A	S	0
	C	N/A	N/A	N/A	N/A	0
Hitachi	N	N/A	N/A	N/A	S	0
Intel	N	5	30	50	100	185
Mitsubishi	N	N/A	N/A	N/A	S	0
Motorola	N	N/A	N/A	N/A	S	0
National Semi.	C	N/A	N/A	N/A	N/A	0
NEC	N	N/A	N/A	N/A	N/A	0
Ricoh	C	N/A	N/A	N/A	N/A	0
Rockwell	N	N/A	N/A	N/A	N/A	0
	C	N/A	N/A	N/A	N/A	0
SGS-Ates	N	N/A	N/A	N/A	N/A	0
Texas Instruments	N	10	35	60	90	195
Toshiba	N	N/A	N/A	N/A	N/A	0
	N	15	65	110	190	380
	C	0	0	0	0	0
Total		15	65	110	190	380
Percentage Change from Previous Quarter		0	333%	69%	73%	
Cumulative Total		20	85	195	385	
ASPs: NMOS		\$80.00	\$80.00	\$75.00	\$75.00	\$76.05
CMOS		0	0	0	0	0
Overall		\$80.00	\$80.00	\$75.00	\$75.00	\$76.05
Revenue (\$M)		1.2	5.2	8.3	14.3	28.9
		1979				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
Market Share						
U.S.		100.0%	100.0%	100.0%	100.0%	100.0%
Japan		0	0	0	0	0
Europe		0	0	0	0	0
Total		100.0%	100.0%	100.0%	100.0%	100.0%

S = Sampling
N/A = Not Available

(Continued)

MOS EPROM--Data

Table 3 (Continued)

32K MOS EPROM Shipment Data, 1978-1987

Company	MOS Process	1980				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	N/A	N/A	S	2	2
Burotechnique	C	N/A	N/A	N/A	N/A	0
Fujitsu	N	S	S	15	100	115
	C	N/A	N/A	N/A	N/A	0
Hitachi	N	S	120	220	280	620
Intel	N	165	250	325	450	1,190
Mitsubishi	N	S	6	40	90	136
Motorola	N	S	30	60	50	145
National Semi.	C	S	10	15	15	40
NEC	N	N/A	N/A	S	15	20
Ricoh	C	N/A	N/A	N/A	N/A	0
Rockwell	N	N/A	N/A	N/A	N/A	0
	C	N/A	N/A	N/A	N/A	0
SGS-Ates	N	N/A	N/A	N/A	N/A	0
Texas Instruments	N	150	300	350	450	1,250
Toshiba	N	N/A	S	S	10	15
	N	320	706	1,020	1,447	3,493
	C	0	10	15	15	40
Total		320	716	1,035	1,462	3,533
Percentage Change from Previous Quarter		68%	124%	45%	41%	
Cumulative Total		705	1,421	2,456	3,918	
ASPs: NMOS		\$55.00	\$40.00	\$30.00	\$10.00	\$26.03
CMOS		0	0	0	0	0
Overall		\$55.00	\$40.00	\$30.00	\$10.00	\$26.03
Revenue (\$M)		17.6	28.2	30.6	14.5	90.9
		1980				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
Market Share						
U.S.		100.0%	82.4%	72.5%	66.1%	74.4%
Japan		0	17.6	27.5	33.9	25.6
Europe		0	0	0	0	0
Total		100.0%	100.0%	100.0%	100.0%	100.0%

S = Sampling
N/A = Not Available

(Continued)

MOS EPROM--Data

Table 3 (Continued)

32K MOS EPROM Shipment Data, 1978-1987

Company	MOS Process	1981				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	10	100	120	310	540
Eurotechnique	C	N/A	N/A	S	S	5
Fujitsu	N	150	170	600	1,000	1,920
	C	N/A	N/A	N/A	N/A	0
Hitachi	N	500	600	900	1,050	3,050
Intel	N	600	700	1,050	1,600	3,950
Mitsubishi	N	190	270	270	660	1,390
Motorola	N	50	120	250	350	770
National Semi.	C	10	20	30	30	90
NEC	N	30	50	325	700	1,105
Ricoh	C	N/A	N/A	N/A	N/A	0
Rockwell	N	N/A	N/A	N/A	N/A	0
	C	N/A	N/A	N/A	N/A	0
SGS-Ates	N	N/A	N/A	N/A	N/A	0
Texas Instruments	N	560	700	900	1,000	3,160
Toshiba	N	10	25	100	180	315
	N	2,100	2,735	4,515	6,850	16,200
	C	10	20	30	35	95
Total		2,110	2,755	4,545	6,885	16,295
Percentage Change from Previous Quarter		44%	31%	65%	51%	
Cumulative Total		6,028	8,783	13,328	20,213	
ASPs: NMOS		\$9.00	\$8.00	\$7.00	\$5.80	\$6.92
CMOS		0	0	0	0	0
Overall		\$9.00	\$8.00	\$7.00	\$5.80	\$6.92
Revenue (\$M)		18.9	21.9	31.6	39.7	112.1
		1981				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
Market Share						
U.S.		58.3%	59.5%	51.7%	47.8%	52.2%
Japan		41.7	40.5	48.3	52.1	47.7
Europe		0	0	0	0	0
Total		100.0%	100.0%	100.0%	100.0%	100.0%

S = Sampling

N/A = Not Available

Note: Columns may not add to totals shown because of rounding.

(Continued)

MOS EPROM--Data

Table 3 (Continued)

32K MOS EPROM Shipment Data, 1978-1987

Company	MOS Process	1982				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	600	1,050	650	850	3,150
Eurotechnique	C	30	100	150	200	480
Fujitsu	N	600	700	1,000	1,200	3,500
	C	N/A	N/A	N/A	S	0
Hitachi	N	1,500	2,500	2,500	2,500	9,000
Intel	N	2,000	2,500	2,500	2,500	9,500
Mitsubishi	N	1,450	1,500	1,800	1,500	6,250
Motorola	N	325	100	100	0	525
National Semi.	C	75	100	220	250	645
NEC	N	1,300	1,600	2,200	2,300	7,400
Ricoh	C	N/A	N/A	N/A	N/A	0
Rockwell	N	N/A	N/A	N/A	N/A	0
	C	N/A	N/A	N/A	N/A	0
SGS-Ates	N	S	10	25	50	85
Texas Instruments	N	500	600	700	900	2,700
Toshiba	N	300	400	600	600	1,900
	N	8,575	10,960	12,075	12,400	44,010
	C	105	200	370	450	1,125
Total		8,680	11,160	12,445	12,850	45,135
Percentage Change from Previous Quarter		26%	29%	12%	3%	
Cumulative Total		28,893	40,053	52,498	65,348	
ASPs: NMOS		\$6.00	\$5.50	\$5.00	\$4.75	\$5.25
CMOS		0	0	0	0	0
Overall		\$6.00	\$5.50	\$5.00	\$4.75	\$5.25
Revenue (\$M)		51.5	60.3	60.4	58.9	231.0
		1982				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
Market Share						
U.S.		40.3%	39.0%	33.5%	35.0%	36.6%
Japan		59.3	60.0	65.1	63.0	62.1
Europe		0.3	1.0	1.4	1.9	1.3
Total		100.0%	100.0%	100.0%	100.0%	100.0%

S = Sampling

N/A = Not Available

Note: Columns may not add to totals shown because of rounding.

(Continued)

MOS EPROM--Data

Table 3 (Continued)

32K MOS EPROM Shipment Data, 1978-1987

Company	MOS Process	1983				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	800	1,000	1,200	1,500	4,500
Eurotechnique	C	200	300	400	400	1,300
Fujitsu	N	1,200	1,500	1,500	1,500	5,700
	C	10	25	50	50	135
Hitachi	N	3,000	3,500	3,500	3,000	13,000
Intel	N	2,500	2,500	2,200	1,800	9,000
Mitsubishi	N	1,600	1,700	1,500	1,300	6,100
Motorola	N	0	0	0	0	0
National Semi.	C	350	450	600	800	2,200
NEC	N	2,400	2,500	1,700	1,700	8,300
Ricoh	C	N/A	N/A	N/A	S	0
Rockwell	N	N/A	N/A	N/A	N/A	0
	C	N/A	N/A	S	25	25
SGS-Ates	N	50	100	100	100	350
Texas Instruments	N	1,000	2,000	3,000	3,500	9,500
Toshiba	N	600	400	500	500	2,000
	N	13,150	15,200	15,200	14,900	58,450
	C	560	775	1,050	1,275	3,660
Total		13,710	15,975	16,250	16,175	62,110
Percentage Change from Previous Quarter						
		7%	17%	2%	0%	
Cumulative Total		79,058	95,033	111,283	127,458	
ASPs: NMOS		\$4.50	\$4.00	\$3.75	\$3.75	\$3.98
CMOS		0	0	0	0	0
Overall		\$4.50	\$4.00	\$3.75	\$3.75	\$3.98
Revenue (\$M)		59.2	60.8	57.0	55.9	232.9
Market Share						
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Year
U.S.		33.9%	37.2%	43.1%	47.1%	40.6%
Japan		64.3	60.3	53.8	49.8	56.7
Europe		1.8	2.5	3.1	3.1	2.7
Total		100.0%	100.0%	100.0%	100.0%	100.0%

S = Sampling
N/A = Not Available

(Continued)

MOS EPROM--Data

Table 3 (Continued)

32K MOS EPROM Shipment Data, 1978-1987

Company	MOS Process	1984				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	1,600	1,800	2,200	2,200	7,800
Fujitsu	N	1,600	1,800	1,500	1,200	6,100
	C	150	250	250	250	900
Hitachi	N	2,500	2,000	1,500	1,200	7,200
Intel	N	1,800	1,800	2,000	2,000	7,600
Mitsubishi	N	1,100	900	650	400	3,050
Motorola	N	0	0	0	0	0
National Semi.	C	900	1,000	1,100	850	3,850
NEC	N	1,400	1,550	1,000	750	4,700
Ricoh	C	S	S	S	100	150
Rockwell	N	N/A	N/A	S	S	0
	C	50	25	0	0	75
SGS	N	200	350	600	1,000	2,150
Texas Instruments	N	3,800	4,000	3,200	2,200	13,200
Thomson-Eurotechnique	C	350	300	300	250	1,200
Toshiba	N	300	150	50	25	525
	N	14,300	14,350	12,700	10,975	52,325
	C	1,450	1,575	1,700	1,450	6,175
Total		15,750	15,925	14,400	12,425	58,500
Percentage Change from Previous Quarter						
		(3%)	1%	(10%)	(14%)	%
Cumulative Total		143,208	159,133	173,533	185,958	
ASPs:	NMOS	\$3.60	\$3.50	\$3.25	\$3.10	\$3.38
	CMOS	\$7.50	\$7.50	\$7.25	\$7.00	\$7.31
	Overall	\$3.96	\$3.90	\$3.72	\$3.56	\$3.80
Revenue (\$M)		62.4	62.0	53.6	44.2	222.2
Market Share						
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Year
U.S.		51.7%	54.2%	59.0%	58.4%	55.6%
Japan		44.8	41.8	34.7	31.6	38.7
Europe		3.5	4.1	6.3	10.1	5.7
Total		100.0%	100.0%	100.0%	100.0%	100.0%

S = Sampling

N/A = Not Available

Note: Columns may not add to totals shown because of rounding.

(Continued)

MOS EPROM--Data

Table 3 (Continued)
32K MOS EPROM Shipment Data, 1978-1987

<u>Company</u>	<u>MOS Process</u>	<u>1985</u>				<u>Year</u>
		<u>1st Qtr.</u>	<u>2nd Qtr.</u>	<u>3rd Qtr.</u>	<u>4th Qtr.</u>	
AMD	N	2,200	2,450	1,750	1,300	7,700
Fujitsu	N	800	600	300	250	1,950
	C	250	250	250	150	900
Hitachi	N	900	700	400	400	2,400
Intel	N	1,800	1,500	1,500	1,500	6,300
Mitsubishi	N	650	1,000	450	300	2,400
Motorola	N	0	0	0	0	0
National Semi.	C	700	600	500	500	2,300
NEC	N	730	500	800	530	2,560
Ricoh	C	150	200	200	150	700
Rockwell	N	50	50	0	0	100
	C	0	0	0	0	0
SGS	N	800	700	850	1,000	3,350
Texas Instruments	N	1,800	1,600	1,500	1,200	6,100
Thomson-Eurotechnique	C	350	400	400	400	1,550
Toshiba	N	0	0	0	0	0
	N	9,730	9,100	7,550	6,480	32,860
	C	1,450	1,450	1,350	1,200	5,450
Total		11,180	10,550	8,900	7,680	38,310
Percentage Change from Previous Quarter						
		(10%)	(6%)	(16%)	(14%)	
Cumulative Total		197,138	207,688	216,588	224,268	
ASPs:	NMOS	\$2.80	\$2.25	\$2.20	\$2.20	\$2.39
	CMOS	\$5.50	\$4.50	\$3.50	\$2.80	\$4.14
	Overall	\$3.15	\$2.56	\$2.40	\$2.29	\$2.64
Revenue (\$M)		35.2	27.0	21.3	17.6	101.2
Market Share						
		<u>1st Qtr.</u>	<u>2nd Qtr.</u>	<u>3rd Qtr.</u>	<u>4th Qtr.</u>	<u>Year</u>
U.S.		58.6%	58.8%	59.0%	58.6%	58.7%
Japan		31.1	30.8	27.0	23.2	28.5
Europe		10.3	10.4	14.0	18.2	12.8
Total		100.0%	100.0%	100.0%	100.0%	100.0%

(Continued)

MOS EPROM--Data

Table 3 (Continued)
32K MOS EPROM Shipment Data, 1978-1987

Company	MOS Process	1986				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	950	850	675	450	2,925
Fujitsu	N	150	50	0	0	200
	C	50	0	0	0	50
Hitachi	N	500	200	100	50	850
Intel	N	1,300	1,300	1,000	1,550	5,150
	OTP	250	250	250	100	850
Mitsubishi	N	0	0	282	7	289
National Semi.	C	400	300	300	300	1,300
NEC	N	330	270	150	100	850
Ricoh	C	50	50	0	0	100
SGS	N	463	350	1,200	1,200	3,213
Texas Instruments	N	1,000	1,000	1,100	1,500	4,600
Thomson-Eurotechnique	C	300	300	300	300	1,200
	N	4,943	4,270	4,757	4,957	18,927
	C	800	650	600	600	2,650
Total		5,743	4,920	5,357	5,557	21,577
Percentage Change from Previous Quarter		(25%)	(14%)	9%	4%	
Cumulative Total		230,011	234,931	240,288	245,845	
ASPs:	NMOS	\$2.10	\$2.15	\$2.20	\$2.25	\$2.18
	CMOS	\$2.50	\$2.75	\$2.80	\$2.85	\$2.71
	Overall	\$2.16	\$2.23	\$2.27	\$2.31	\$2.24
Revenue (\$M)		12.4	11.0	12.1	12.9	48.4
		1986				
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Year
Market Share						
U.S.		67.9%	75.2%	62.1%	70.2%	68.7%
Japan		18.8	11.6	9.9	2.8	10.8
Europe		13.3	13.2	28.0	27.0	20.5
Total		100.0%	100.0%	100.0%	100.0%	100.0%

(Continued)

MOS EPROM--Data

Table 3 (Continued)

32K MOS EPROM Shipment Data, 1978-1987

Company	MOS Process	1987				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	400	450	475	510	1,835
Fujitsu	N	0	0	0	0	0
	C	0	0	0	0	0
Hitachi	N	0	0	0	0	0
Intel	N	1,050	1,300	1,100	1,100	4,550
	OTP	0	0	0	0	0
Mitsubishi	N	0	0	0	0	0
National Semi.	C	750	750	744	628	2,872
NEC	N	100	20	20	10	150
Ricoh	C	0	0	0	0	0
SGS-Thomson	N	685	550	470	560	2,265
	C	75	65	50	45	235
Texas Instruments	N	1,500	1,000	1,000	800	4,300
	N	3,735	3,320	3,065	2,980	13,100
	C	825	815	794	673	3,107
Total		4,560	4,135	3,859	3,653	16,207
Percentage Change from Previous Quarter		(18%)	(9%)	(7%)	(5%)	
Cumulative Total		250,405	254,540	258,399	262,052	
ASPs:	NMOS	\$2.50	\$2.75	\$2.90	\$3.00	\$2.77
	CMOS	\$2.90	\$3.00	\$3.20	\$3.25	\$3.08
	Overall	\$2.57	\$2.80	\$2.96	\$3.05	\$2.83
Revenue (\$M)		11.7	11.6	11.4	11.1	45.9
		1987				
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Year
Market Share						
U.S.		81.1%	84.6%	86.0%	83.2%	83.6%
Japan		2.2	0.5	0.5	0.3	0.9
Europe		16.7	14.9	13.5	16.6	15.4
Total		100.0%	100.0%	100.0%	100.0%	100.0%

Note: Columns may not add to totals shown because of rounding.

Source: Dataquest
May 1989

MOS EPROM--Data

Table 4

64K MOS EPROM Shipment Data, 1980-1987

Company	MOS Process	1980				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	N/A	N/A	N/A	N/A	0
Fujitsu	N	N/A	N/A	N/A	N/A	0
	C	N/A	N/A	N/A	N/A	0
Hitachi	N	N/A	N/A	N/A	S	0
	C	N/A	N/A	N/A	N/A	0
Intel	N	N/A	N/A	N/A	S	0
	N	N/A	N/A	N/A	N/A	0
Mitsubishi	N	N/A	N/A	N/A	N/A	0
Mostek	N	N/A	N/A	N/A	S	0
Motorola	N	S	S	S	S	10
NEC	N	N/A	N/A	N/A	N/A	0
	C	N/A	N/A	N/A	N/A	0
Oki Electric	N	N/A	N/A	N/A	N/A	0
Ricoh	C	N/A	N/A	N/A	N/A	0
Rockwell	N	N/A	N/A	N/A	N/A	0
	C	N/A	N/A	N/A	N/A	0
SEEQ	N	N/A	N/A	N/A	N/A	0
Seiko-Epson	C	N/A	N/A	N/A	N/A	0
SGS-Ates	N	N/A	N/A	N/A	N/A	0
Sharp	C	N/A	N/A	N/A	N/A	0
Signetics	C	N/A	N/A	N/A	N/A	0
Texas Instruments	N	N/A	S	10	20	30
Toshiba	N	N/A	N/A	N/A	N/A	0
VLSI Technology	C	N/A	N/A	N/A	N/A	0
WaferScale	N	N/A	N/A	N/A	N/A	0
	N	0	0	15	25	40
	C	0	0	0	0	0
Total		0	0	15	25	40
Percentage Change from Previous Quarter						
		0	0	0	67%	
Cumulative Total						
		0	0	15	40	
ASPs: NMOS						
		0	0	0	0	0
CMOS						
		0	0	0	0	0
Overall						
		\$200.00	\$100.00	\$80.00	\$70.00	\$73.75
Revenue (\$M)						
		0	0	1.2	1.8	3.0
Market Share						
U.S.		0	0	100.0%	100.0%	100.0%
Japan		0	0	0	0	0
Europe		0	0	0	0	0
Total		0	0	100.0%	100.0%	100.0%

S = Sampling
N/A = Not Available

(Continued)

MOS EPROM--Data

Table 4 (Continued)
64K MOS EPROM Shipment Data, 1980-1987

Company	MOS Process	1981				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	N/A	N/A	N/A	N/A	0
Fujitsu	N	S	1	15	100	116
	C	N/A	N/A	N/A	N/A	0
Hitachi	N	S	2	5	25	32
	C	N/A	N/A	N/A	N/A	0
Intel	N	10	70	200	500	780
	N	N/A	N/A	N/A	N/A	0
Mitsubishi	N	N/A	N/A	N/A	N/A	0
Mostek	N	S	2	5	3	10
Motorola	N	15	40	30	50	135
NEC	N	N/A	N/A	N/A	S	0
	C	N/A	N/A	N/A	N/A	0
Oki Electric	N	N/A	N/A	N/A	N/A	0
Ricoh	C	N/A	N/A	N/A	N/A	0
Rockwell	N	N/A	N/A	N/A	N/A	0
	C	N/A	N/A	N/A	N/A	0
SEEQ	N	N/A	N/A	N/A	N/A	0
Seiko-Epson	C	N/A	N/A	N/A	N/A	0
SGS-Ates	N	N/A	N/A	N/A	N/A	0
Sharp	C	N/A	N/A	N/A	N/A	0
Signetics	C	N/A	N/A	N/A	N/A	0
Texas Instruments	N	30	65	100	100	295
Toshiba	N	N/A	N/A	N/A	N/A	0
VLSI Technology	C	N/A	N/A	N/A	N/A	0
WaferScale	N	N/A	N/A	N/A	N/A	0
	N	55	180	355	778	1,368
	C	0	0	0	0	0
Total		55	180	355	778	1,368
Percentage Change from Previous Quarter						
		120%	227%	97%	119%	
Cumulative Total		95	275	630	1,408	
ASPs:	NMOS	0	0	0	0	0
	CMOS	0	0	0	0	0
Overall		\$70.00	\$60.00	\$38.00	\$24.00	\$34.22
Revenue (\$M)		3.9	10.8	13.5	18.7	46.8
Market Share						
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Year
U.S.		100.0%	98.3%	94.4%	83.9%	89.2%
Japan		0	1.7	5.6	16.1	10.8
Europe		0	0	0	0	0
Total		100.0%	100.0%	100.0%	100.0%	100.0%

S = Sampling
N/A = Not Available

(Continued)

MOS EPROM--Data

Table 4 (Continued)

64K MOS EPROM Shipment Data, 1980-1987

Company	MOS Process	1982				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	S	10	250	500	760
Fujitsu	N	400	1,000	1,500	2,000	4,900
	C	10	25	50	100	185
Hitachi	N	100	250	600	800	1,750
	C	N/A	N/A	N/A	N/A	0
Intel	N	800	1,700	2,500	2,500	7,500
	N	N/A	N/A	N/A	N/A	0
Mitsubishi	N	S	15	500	1,400	1,915
Mostek	N	0	0	0	0	0
Motorola	N	60	100	100	100	360
NEC	N	S	10	60	200	270
	C	N/A	N/A	N/A	N/A	0
Oki Electric	N	N/A	N/A	N/A	S	0
Ricoh	C	N/A	N/A	N/A	N/A	0
Rockwell	N	N/A	N/A	N/A	N/A	0
	C	N/A	N/A	N/A	N/A	0
SEEQ	N	N/A	S	5	15	20
Seiko-Epson	C	N/A	N/A	N/A	N/A	0
SGS-Ates	N	N/A	N/A	N/A	N/A	0
Sharp	C	N/A	N/A	N/A	N/A	0
Signetics	C	N/A	N/A	N/A	N/A	0
Texas Instruments	N	100	100	100	100	400
Toshiba	N	N/A	S	20	50	70
VLSI Technology	C	N/A	N/A	N/A	N/A	0
WaferScale	N	N/A	N/A	N/A	N/A	0
	N	1,460	3,185	5,635	7,665	17,945
	C	10	25	50	100	185
Total		1,470	3,210	5,685	7,765	18,130
Percentage Change from Previous Quarter		89%	118%	77%	37%	
Cumulative Total		2,878	6,088	11,773	19,538	
ASPs: NMOS		0	0	0	0	0
CMOS		0	0	0	0	0
Overall		\$15.00	\$11.50	\$8.50	\$6.50	\$8.70
Revenue (\$M)		22.1	36.9	48.3	50.5	157.8
Market Share		1982				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
U.S.		65.3%	59.5%	52.0%	41.4%	49.9%
Japan		34.7	40.5	48.0	58.6	50.1
Europe		0	0	0	0	0
Total		100.0%	100.0%	100.0%	100.0%	100.0%

S = Sampling
N/A = Not Available

(Continued)

MOS EPROM--Data

Table 4 (Continued)

64K MOS EPROM Shipment Data, 1980-1987

Company	MOS Process	1983				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	600	900	1,300	1,800	4,600
Fujitsu	N	2,200	2,400	2,500	3,000	10,100
	C	250	300	350	400	1,300
Hitachi	N	1,500	2,300	3,500	5,500	12,800
	C	N/A	S	50	50	100
Intel	N	3,000	3,500	4,000	3,500	14,000
	N	N/A	N/A	N/A	N/A	0
Mitsubishi	N	1,700	2,000	3,200	3,800	10,700
Mostek	N	0	0	0	0	0
Motorola	N	150	200	450	700	1,500
NEC	N	350	500	500	600	1,950
	C	N/A	N/A	N/A	N/A	0
Oki Electric	N	25	50	100	200	375
Ricoh	C	N/A	N/A	N/A	N/A	0
Rockwell	N	N/A	N/A	N/A	N/A	0
	C	N/A	N/A	N/A	N/A	0
SEEQ	N	25	100	310	600	1,035
Seiko-Epson	C	N/A	N/A	N/A	N/A	0
SGS-Ates	N	N/A	N/A	N/A	S	0
Sharp	C	N/A	N/A	N/A	N/A	0
Signetics	C	N/A	N/A	S	S	0
Texas Instruments	N	400	800	1,500	2,000	4,700
Toshiba	N	200	400	400	600	1,600
VLSI Technology	C	N/A	N/A	N/A	N/A	0
WaferScale	N	N/A	N/A	N/A	N/A	0
	N	10,150	13,150	17,760	22,300	63,360
	C	250	300	400	450	1,400
Total		10,400	13,450	18,160	22,750	64,760
Percentage Change from Previous Quarter						
		34%	29%	35%	25%	
Cumulative Total						
		29,938	43,388	61,548	84,298	
ASPs: NMOS						
		0	0	0	0	0
CMOS						
		0	0	0	0	0
Overall						
		\$5.50	\$4.75	\$5.00	\$5.50	\$5.20
Revenue (\$M)						
		57.2	63.9	90.8	125.1	337.0
Market Share						
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Year
U.S.		40.1%	40.9%	41.6%	37.8%	39.9%
Japan		59.9	59.1	58.4	62.2	60.1
Europe		0	0	0	0	0
Total		100.0%	100.0%	100.0%	100.0%	100.0%

S = Sampling
N/A = Not Available

(Continued)

MOS EPROM--Data

Table 4 (Continued)

64K MOS EPROM Shipment Data, 1980-1987

Company	MOS Process	1984				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	1,200	1,300	1,600	1,700	5,800
Fujitsu	N	2,500	2,800	3,000	3,000	11,300
	C	500	600	700	900	2,700
Hitachi	N	4,000	5,000	6,000	6,000	21,000
	C	100	250	300	350	1,000
Intel	N	2,000	2,000	2,000	2,000	8,000
	N	N/A	N/A	N/A	S	0
Mitsubishi	N	5,000	5,700	5,700	5,000	21,400
Mostek	N	0	0	0	0	0
Motorola	N	900	900	600	500	2,900
NEC	N	800	1,400	900	1,200	4,300
	C	N/A	N/A	N/A	S	0
Oki Electric	N	400	600	500	400	1,900
Ricoh	C	N/A	0	25	100	125
Rockwell	N	S	10	0	0	10
	C	10	50	0	0	60
SEEQ	N	800	1,000	1,050	1,100	3,950
Seiko-Epson	C	N/A	N/A	N/A	N/A	0
SGS	N	50	150	350	600	1,150
Sharp	C	N/A	N/A	N/A	N/A	0
Signetics	C	S	10	10	10	30
Texas Instruments	N	2,400	2,600	2,800	2,400	10,200
Toshiba	N	400	1,200	800	500	2,900
VLSI Technology	C	N/A	N/A	N/A	N/A	0
WaferScale	N	N/A	N/A	N/A	N/A	0
	N	20,450	24,660	25,300	24,400	94,810
	C	610	910	1,035	1,360	3,915
Total		21,060	25,570	26,335	25,760	98,725
Percentage Change from Previous Quarter		(7%)	21%	3%	(2%)	
Cumulative Total		105,358	130,928	157,263	183,023	
ASPs:	NMOS	\$5.25	\$5.25	\$4.75	\$4.25	\$4.86
	CMOS	\$15.00	\$15.00	\$13.50	\$10.00	\$12.87
	Overall	\$5.53	\$5.60	\$5.09	\$4.55	\$5.18
Revenue (\$M)		116.5	143.1	134.1	117.3	511.1
				1984		
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Year
Market Share						
U.S.		34.7%	30.8%	30.6%	29.9%	31.3%
Japan		65.1	68.6	68.1	67.7	67.5
Europe		0.2	0.6	1.3	2.3	1.2
Total		100.0%	100.0%	100.0%	100.0%	100.0%

S * Sampling

N/A = Not Available

Note: Columns may not add to totals shown because of rounding.

(Continued)

MOS EPROM--Data

Table 4 (Continued)

64K MOS EPROM Shipment Data, 1980-1987

Company	MOS Process	1985				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	2,100	1,550	1,825	1,150	6,625
Fujitsu	N	3,500	3,500	3,800	3,500	14,300
	C	800	950	1,000	1,200	3,950
Hitachi	N	5,500	5,200	5,000	4,500	20,200
	C	400	400	450	500	1,750
Intel	N	2,600	3,000	3,000	2,900	11,500
	N	25	75	150	250	500
Mitsubishi	N	4,850	2,600	4,300	4,200	15,950
Mostek	N	0	0	0	0	0
Motorola	N	400	300	300	400	1,400
NEC	N	1,250	1,450	1,650	1,800	6,150
	C	40	200	350	300	890
Oki Electric	N	350	300	200	150	1,000
Ricoh	C	200	250	250	150	850
Rockwell	N	0	0	0	0	0
	C	0	0	0	0	0
SEBQ	N	625	500	350	275	1,750
Seiko-Epson	C	N/A	N/A	N/A	S	0
SGS	N	880	850	1,000	1,350	4,080
Sharp	C	N/A	N/A	N/A	S	0
Signetics	C	0	0	0	0	0
Texas Instruments	N	2,200	2,000	2,000	2,000	8,200
Toshiba	N	800	600	500	350	2,250
VLSI Technology	C	N/A	S	20	40	60
WaferScale	N	N/A	N/A	S	10	10
	N	25,080	21,925	24,075	22,825	93,905
	C	1,440	1,800	2,070	2,200	7,510
Total		26,520	23,725	26,145	25,025	101,415
Percentage Change from Previous Quarter		3%	(11%)	10%	(4%)	
Cumulative Total		209,543	233,268	259,413	284,438	
ASPs:	NMOS	\$3.60	\$2.80	\$2.35	\$2.10	\$2.73
	CMOS	\$6.00	\$4.55	\$3.75	\$3.25	\$4.23
	Overall	\$3.63	\$2.93	\$2.46	\$2.20	\$2.84
Revenue (\$M)		98.9	69.6	64.3	55.1	287.9
		1985				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
Market Share						
U.S.		30.0%	31.3%	29.2%	28.1%	29.6%
Japan		66.7	65.1	66.9	66.5	66.4
Europe		3.3	3.6	3.8	5.4	4.0
Total		100.0%	100.0%	100.0%	100.0%	100.0%

S = Sampling

N/A = Not Available

Note: Columns may not add to totals shown because of rounding.

(Continued)

MOS EPROM--Data

Table 4 (Continued)

64K MOS EPROM Shipment Data, 1980-1987

Company	MOS Process	1986				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	850	800	900	1,385	3,935
Fujitsu	N	1,500	1,500	2,000	4,000	9,000
	C	1,000	1,000	2,000	4,000	8,000
General Instruments	C	S	0	31	170	201
	OTP	N/A	N/A	S	10	10
Gold Star	C	S	S	0	5	5
Hitachi	N	5,400	5,000	4,500	4,000	18,900
	C	700	700	700	700	2,800
Hyundai	C	S	S	0	5	5
Intel	N	1,400	3,300	2,400	3,200	12,300
	C	250	500	425	400	1,575
	N OTP	400	400	300	200	1,300
	C OTP	0	30	130	100	260
Mitsubishi	N	3,226	3,339	3,459	2,810	12,834
	OTP	775	43	564	511	1,893
Motorola	N	147	346	177	114	784
	OTP	66	87	54	22	229
National Semi.	C	25	75	150	200	450
NBC	N	1,850	1,000	300	150	3,300
	C	800	1,000	490	300	2,590
	OTP	240	140	100	50	530
Ricoh	C	0	0	25	50	75
SEBQ	N	525	615	315	150	1,605
Seiko-Epson	C	0	75	100	150	325
SGS	N	552	608	2,500	2,500	6,160
Sharp	C	0	5	10	15	30
	OTP	S	S	0	0	0
Signetics	C	0	5	5	10	20
Texas Instruments	N	1,400	1,400	1,800	1,600	6,200
Toshiba	N	500	600	600	900	2,600
	OTP	100	400	500	500	1,500
VLSI Technology	C	40	40	40	50	170
WaferScale	C	0	10	10	10	30
Others	C	0	0	5	5	10
	N	20,691	19,438	20,369	22,042	82,540
	C	3,055	3,580	4,221	6,230	17,086
Total		23,746	23,018	24,590	28,272	99,626
Percentage Change from Previous Quarter		(5%)	(3%)	7%	15%	
Cumulative Total		308,184	331,202	355,792	384,064	
ASPs:	NMOS	\$2.15	\$2.35	\$2.60	\$2.75	\$2.47
	CMOS	\$3.50	\$3.75	\$3.85	\$4.10	\$3.86
	Overall	\$2.32	\$2.57	\$2.81	\$3.05	\$2.71
Revenue (\$M)		55.2	59.1	69.2	86.2	269.7
		1986				
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Year
Market Share						
U.S.		29.9%	33.1%	27.4%	27.0%	29.2%
Japan		67.8	64.3	62.4	64.1	64.6
Europe		2.3	2.6	10.2	8.8	6.2
ROW		0	0	0	0	0
Total		100.0%	100.0%	100.0%	100.0%	100.0%

S = Sampling

N/A = Not Available

Note: Columns may not add to totals shown because of rounding.

(Continued)

MOS EPROM--Data

Table 4 (Continued)
64K MOS EPROM Shipment Data, 1980-1987

Company	MOS Process	1987				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	1,300	1,500	1,170	1,600	5,570
Cypress	C	50	75	100	100	325
Fujitsu	N	400	1,000	1,000	1,000	3,400
	C	1,800	2,000	2,200	2,200	8,200
Gold Star	C	5	5	5	5	20
Hitachi	N	2,500	1,500	1,000	0	5,000
	C	700	700	400	0	1,800
	C OTP	0	50	100	0	150
Hyundai	C	5	5	10	20	40
Intel	N	1,400	1,400	1,100	1,700	5,600
	C	400	400	500	400	1,700
	N OTP	350	300	150	250	1,050
	C OTP	200	250	200	200	850
Microchip Tech., Inc.	C	100	299	202	632	1,233
	OTP	10	20	50	100	180
Mitsubishi	N	1,450	1,150	1,250	1,600	5,450
	OTP	450	250	200	300	1,200
Motorola	N	125	100	86	60	371
	OTP	17	10	13	6	46
National Semi.	C	606	1,198	1,580	2,341	5,725
	C OTP	N/A	N/A	N/A	8	0
NEC	N	400	60	70	0	530
	C	1,000	370	390	200	1,960
	OTP	0	0	0	0	0
Oki Electric	N	50	50	50	50	200
	N OTP	450	450	400	350	1,650
Ricoh	C	50	50	100	100	300
SZEG	N	200	200	200	200	800
Seiko-Epson	C	100	100	100	100	400
SGS-Thomson	N	870	1,645	2,080	2,100	6,695
	C	80	110	40	100	330
	C OTP	5	45	70	100	220
Sharp	C	0	80	150	250	480
	OTP	0	0	0	0	0
Signetics	C	200	450	800	1,100	2,550
Texas Instruments	N	1,100	1,200	1,350	1,400	5,050
Toshiba	N	700	500	500	200	1,900
	N OTP	1,000	1,000	1,000	1,000	4,000
VLSI Technology	C	75	100	100	100	375
WaferScale	C	30	50	50	50	180
	N	12,762	12,315	11,619	11,816	48,512
	C	<u>5,416</u>	<u>6,407</u>	<u>7,247</u>	<u>8,098</u>	<u>27,168</u>
Total		18,178	18,722	18,866	19,914	75,680

(Continued)

MOS EPROM--Data

Table 4 (Continued)

64K MOS EPROM Shipment Data, 1980-1987

	1987				Year
	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
Percentage Change from Previous Quarter	(36%)	(3%)	1%	6%	
Cumulative Total	402,242	420,964	439,830	459,744	
ASPs: NMOS	\$2.80	\$2.90	\$3.00	\$3.10	\$2.95
CMOS	\$3.00	\$3.10	\$3.00	\$3.20	\$3.08
Overall	\$2.86	\$2.97	\$3.00	\$3.14	\$3.00
Revenue (\$M)	52.0	55.6	56.6	62.5	226.7
	1987				Year
	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
Market Share					
U.S.	32.8%	37.9%	36.3%	45.9%	38.4%
Japan	60.8	49.7	47.2	36.9	48.4
Europe	6.4	12.0	15.8	17.0	12.9
ROW	0.1	0.3	0.6	0.1	0.3
Total	100.0%	100.0%	100.0%	100.0%	100.0%

S = Sampling

N/A = Not Available

Note: Columns may not add to totals shown because of rounding.

Source: Dataquest
May 1989

MOS EPROM--Data

Table 5

128K MOS EPROM Shipment Data, 1982-1987

Company	MOS Process	1982				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	N/A	N/A	N/A	S	0
Fujitsu	N	N/A	N/A	N/A	S	0
	C	N/A	N/A	N/A	N/A	0
Mitachi	N	N/A	N/A	N/A	S	0
Intel	N	3	15	50	150	218
Mitsubishi	N	N/A	N/A	N/A	N/A	0
	C	N/A	N/A	N/A	N/A	0
NEC	N	N/A	N/A	N/A	N/A	0
SEEQ	N	N/A	N/A	N/A	S	0
Texas Instruments	N	N/A	S	5	5	10
	C	N/A	N/A	N/A	N/A	0
Toshiba	N	N/A	N/A	N/A	N/A	N/A
	N	3	15	55	155	228
	C	0	0	0	0	0
Total		3	15	55	155	228

Percentage Change from
Previous Quarter

0 400% 267% 182%

Cumulative Total

3 18 73 228

Average Selling Price

\$75.00 \$60.00 \$50.00 \$40.00 \$44.19

Revenue (\$M)

0.2 0.9 2.8 6.2 10.1

	1982				Year
	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
Market Share					
U.S.	100.0%	100.0%	100.0%	100.0%	100.0%
Japan	0	0	0	0	0
Europe	0	0	0	0	0
Total	100.0%	100.0%	100.0%	100.0%	100.0%

S = Sampling

N/A = Not Available

(Continued)

MOS EPROM--Data

Table 5 (Continued)

128K MOS EPROM Shipment Data, 1982-1987

Company	MOS Process	1983				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	50	175	300	500	1,025
Fujitsu	N	10	50	150	350	560
	C	S	10	25	35	70
Hitachi	N	10	50	150	350	560
Intel	N	450	800	1,200	1,500	3,950
Mitsubishi	N	S	10	10	10	30
	C	N/A	N/A	N/A	N/A	0
NEC	N	S	10	20	100	130
SEEQ	N	N/A	S	50	100	150
Texas Instruments	N	0	0	0	0	0
	C	N/A	N/A	N/A	N/A	0
Toshiba	N	S	10	20	50	80
	N	520	1,105	1,900	2,960	6,485
	C	0	10	25	35	70
Total		520	1,115	1,925	2,995	6,555
Percentage Change from Previous Quarter						
		235%	114%	73%	56%	
Cumulative Total						
		748	1,863	3,788	6,783	
Average Selling Price						
		\$30.00	\$22.00	\$17.00	\$16.00	\$18.44
Revenue (\$M)						
		15.6	24.5	32.7	47.9	120.8
Market Share						
		96.2%	87.4%	80.5%	70.1%	78.2%
U.S.		3.8	12.6	19.5	29.9	21.8
Japan		0	0	0	0	0
Europe		0	0	0	0	0
Total		100.0%	100.0%	100.0%	100.0%	100.0%

S = Sampling
N/A = Not Available

(Continued)

MOS EPROM--Data

Table 5 (Continued)

128K MOS EPROM Shipment Data, 1982-1987

Company	MOS Process	1984				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	500	800	850	900	3,050
Fujitsu	N	550	750	800	700	2,800
	C	50	75	100	100	325
Hitachi	N	650	1,800	2,000	2,800	7,250
Intel	N	1,500	1,600	1,700	2,200	7,000
Mitsubishi	N	60	400	1,500	2,200	4,160
	C	N/A	N/A	N/A	S	0
NEC	N	20	160	600	1,000	1,780
SBBQ	N	150	400	525	575	1,650
Texas Instruments	N	10	25	25	25	85
	C	N/A	N/A	N/A	N/A	0
Toshiba	N	100	300	500	900	1,800
	N	3,540	6,235	8,500	11,300	29,575
	C	50	75	100	100	325
Total		3,590	6,310	8,600	11,400	29,900
Percentage Change from Previous Quarter						
		20%	76%	36%	33%	
Cumulative Total		10,373	16,683	25,283	36,683	
ASPs: NMOS		\$15.25	\$14.00	\$12.25	\$10.00	\$12.12
CMOS		\$28.00	\$25.00	\$20.00	\$18.00	\$21.77
Overall		\$15.43	\$14.13	\$12.34	\$10.07	\$12.22
Revenue (\$M)		55.4	89.2	106.1	114.8	365.5
Market Share						
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Year
U.S.		60.2%	44.8%	36.0%	32.5%	39.4%
Japan		39.8	55.2	64.0	67.5	60.6
Europe		0	0	0	0	0
Total		100.0%	100.0%	100.0%	100.0%	100.0%

S = Sampling
N/A = Not Available

(Continued)

MOS EPROM--Data

Table 5 (Continued)
128K MOS EPROM Shipment Data, 1982-1987

Company	MOS Process	1985				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	1,150	950	850	900	3,850
Fujitsu	N	1,000	1,500	1,750	2,000	6,250
	C	100	100	100	100	400
Hitachi	N	3,000	3,200	3,500	3,100	12,800
Intel	N	2,000	1,800	2,000	2,200	8,000
Mitsubishi	N	1,800	2,000	2,700	3,000	9,500
	C	5	10	10	100	125
NBC	N	1,500	2,000	1,750	3,200	8,450
SEEQ	N	375	300	250	225	1,150
Texas Instruments	N	50	25	0	0	75
	C	N/A	N/A	S	25	25
Toshiba	N	1,000	1,200	1,500	1,500	5,200
	N	11,875	12,975	14,300	16,125	55,275
	C	105	110	110	225	550
Total		11,980	13,085	14,410	16,350	55,825
Percentage Change from Previous Quarter						
		5%	9%	10%	13%	
Cumulative Total						
		48,663	61,748	76,158	92,508	
ASPs: NMOS						
		\$6.50	\$4.10	\$3.10	\$2.60	\$3.92
CMOS						
		\$15.00	\$9.00	\$5.00	\$3.75	\$7.20
Overall						
		\$6.57	\$4.14	\$3.11	\$2.62	\$3.95
Revenue (\$M)						
		78.8	54.2	44.9	42.8	220.6
Market Share						
U.S.		29.8%	23.5%	21.5%	20.5%	23.5%
Japan		70.2	76.5	78.5	79.5	76.5
Europe		0	0	0	0	0
Total		100.0%	100.0%	100.0%	100.0%	100.0%

S = Sampling
N/A = Not Available

(Continued)

MOS EPROM--Data

Table 5 (Continued)

128K MOS EPROM Shipment Data, 1982-1987

Company	MOS Process	1986				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	1,300	1,100	1,050	1,715	5,165
Fujitsu	N	800	800	800	800	3,200
	C	100	100	100	100	400
General Instrument	C	N/A	S	20	150	170
	OTP	N/A	N/A	S	10	10
Hitachi	N	3,200	3,000	2,500	2,500	11,200
Intel	N	2,200	2,600	2,800	2,900	10,500
	OTP	200	500	650	400	1,750
Mitsubishi	N	2,300	1,850	1,800	1,700	7,650
	C	75	70	90	120	355
	N OTP	650	650	550	300	2,150
	C OTP	0	0	0	0	0
NEC	N	3,110	3,000	1,520	1,000	8,630
SEEQ	N	325	325	300	225	1,175
Seiko-Epson	N	0	10	15	25	50
Texas Instruments	N	N/A	N/A	N/A	N/A	0
	C	100	175	225	400	900
Toshiba	N	700	700	700	600	2,700
	OTP	50	200	400	600	1,250
VLSI Technology	C	5	10	10	10	35
WaferScale	C	S	0	5	5	10
Others	C	N/A	S	5	10	15
	N	14,835	14,735	13,085	12,780	55,435
	C	280	355	455	805	1,895
Total		15,115	15,090	13,540	13,585	57,330
Percentage Change from Previous Quarter						
		(8%)	0	(10%)	0	
Cumulative Total		107,623	122,713	136,253	149,838	
ASPs: NMOS		\$2.55	\$2.65	\$2.75	\$2.75	\$ 2.67
CMOS		\$3.70	\$3.90	\$4.00	\$4.00	\$ 3.94
Overall		\$2.57	\$2.68	\$2.79	\$2.82	\$ 2.71
Revenue (\$M)		38.9	40.4	37.8	38.4	155.5
Market Share						
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Year
U.S.		27.3%	31.2%	37.4%	42.9%	34.4%
Japan		72.7	68.8	62.6	57.0	65.6
Europe		0.0	0.0	0.0	0.1	0.0
Total		100.0%	100.0%	100.0%	100.0%	100.0%

S = Sampling
N/A = Not Applicable

(Continued)

MOS EPROM--Data

Table 5 (Continued)

128K MOS EPROM Shipment Data, 1982-1987

Company	MOS Process	1987				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	1,300	1,925	1,725	1,900	6,850
Fujitsu	N	1,000	1,200	1,100	1,100	4,400
	C	600	800	900	900	3,200
Hitachi	N	2,000	2,000	1,800	0	5,800
Intel	N	2,200	2,250	1,000	2,250	7,700
	N OTP	800	600	420	140	1,960
	C	0	100	250	300	650
	C OTP	0	0	20	20	40
Microchip Tech., Inc.	C	141	227	420	741	1,529
	C OTP	20	45	80	228	373
Mitsubishi	N	1,150	1,300	1,400	950	4,800
	C	40	100	130	60	330
	N OTP	120	250	300	100	770
	C OTP	0	0	0	0	0
National Semi.	C	222	191	223	390	1,026
NEC	N	900	590	430	330	2,250
Oki Electric	N	100	150	100	100	450
	N OTP	0	0	0	0	0
SEEQ	N	150	150	100	100	500
Seiko-Epson	N	0	10	15	25	50
SGS-Thomson	N	180	525	1,160	1,700	3,565
Texas Instruments	N	0	25	25	70	120
	C	800	950	1,100	1,200	4,050
Toshiba	N	500	500	1,000	1,000	3,000
	N OTP	900	1,000	1,000	1,200	4,100
VLSI Technology	C	5	10	10	10	35
WaferScale	C	5	0	5	5	10
	N	11,300	12,475	11,575	10,965	46,315
	C	1,828	2,423	3,138	3,854	11,243
Total		13,128	14,898	14,713	14,819	57,558
Percentage Change from Previous Quarter		(3%)	13%	(1%)	1%	
Cumulative Total		162,966	177,864	192,577	207,396	
ASPs: NMOS		\$3.00	\$3.35	\$3.45	\$3.75	\$ 3.38
CMOS		\$3.90	\$3.80	\$3.90	\$4.25	\$ 4.00
Overall		\$3.13	\$3.42	\$3.54	\$3.88	\$ 3.50
Revenue (\$M)		41.0	51.0	52.2	57.5	201.7

	1987				Year
	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
Market Share					
U.S.	42.9%	43.4%	36.6%	49.6%	43.2%
Japan	55.7	53.0	55.6	38.9	50.6
Europe	1.4	3.5	7.9	11.5	6.2
Total	100.0%	100.0%	100.0%	100.0%	100.0%

S = Sampling

N/A = Not Applicable

Note: Columns may not add to totals shown because of rounding.

Source: Dataquest
May 1989

MOS EPROM--Data

Table 6

256K MOS EPROM Shipment Data, 1983-1987

Company	MOS Process	1983				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	N/A	S	10	25	35
Atmel	N	N/A	N/A	N/A	N/A	0
	C	N/A	N/A	N/A	N/A	0
Fujitsu	N	N/A	N/A	N/A	N/A	0
	C	S	S	5	20	25
General Instrument	N	N/A	N/A	N/A	N/A	0
	C	N/A	N/A	N/A	N/A	0
Hitachi	N	N/A	N/A	N/A	N/A	0
	C	N/A	N/A	N/A	N/A	0
Intel	N	5	10	35	90	140
	C	N/A	N/A	N/A	N/A	0
Mitsubishi	N	N/A	N/A	N/A	S	0
National Semi.	C	N/A	N/A	N/A	N/A	0
NEC	N	N/A	N/A	N/A	S	0
	C	N/A	N/A	N/A	N/A	0
SEEQ	C	N/A	N/A	N/A	N/A	0
Seiko-Epson	C	N/A	N/A	N/A	N/A	0
SGS-Ates	N	N/A	N/A	N/A	N/A	0
Texas Instruments	C	N/A	N/A	N/A	N/A	0
Toshiba	N	N/A	N/A	N/A	N/A	0
	C	N/A	N/A	N/A	N/A	0
VLSI Technology	C	N/A	N/A	N/A	N/A	0
WaferScale	C	N/A	N/A	N/A	N/A	0
	N	5	10	45	115	175
	C	0	0	5	20	25
Total		5	10	50	135	200
Percentage Change from Previous Quarter						
		0	100%	400%	170%	
Cumulative Total						
		5	15	65	200	
ASPs: NMOS						
		\$150	\$125	\$100	\$95	\$100
CMOS						
		0	0	\$145	\$115	\$121
Overall						
		\$150	\$125	\$105	\$98	\$102
Revenue (\$M)						
		0.8	1.3	5.2	13.2	20.5
Market Share						
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Year
U.S.		100.0%	100.0%	90.0%	85.2%	87.5%
Japan		0	0	10.0	14.8	12.5
Europe		0	0	0	0	0
Total		100.0%	100.0%	100.0%	100.0%	100.0%

S = Sampling
N/A = Not Available

(Continued)

MOS EPROM--Data

Table 6 (Continued)

256K MOS EPROM Shipment Data, 1983-1987

Company	MOS Process	1984				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	100	130	100	250	580
Atmel	N	N/A	N/A	N/A	N/A	0
	C	N/A	N/A	N/A	N/A	0
Fujitsu	N	N/A	N/A	N/A	10	10
	C	30	40	50	75	195
General Instrument	N	N/A	N/A	N/A	N/A	0
	C	N/A	N/A	N/A	N/A	0
Hitachi	N	N/A	N/A	S	S	0
	C	N/A	N/A	S	S	0
Intel	N	150	250	375	475	1,250
	C	N/A	N/A	N/A	N/A	0
Mitsubishi	N	S	S	S	5	5
National Semi.	C	N/A	N/A	N/A	N/A	0
NEC	N	S	S	S	5	5
	C	N/A	N/A	N/A	N/A	0
SEEQ	C	N/A	S	S	5	5
Seiko-Epson	C	N/A	N/A	N/A	N/A	0
SGS	N	N/A	N/A	N/A	N/A	0
Texas Instruments	C	N/A	N/A	N/A	N/A	0
Tohiba	N	10	30	50	100	190
	C	N/A	N/A	S	S	0
VLSI Technology	C	N/A	N/A	N/A	N/A	0
WaferScale	C	N/A	—	—	—	0
	N	260	410	525	845	2,040
	C	30	40	50	80	200
Total		290	450	575	925	2,240
Percentage Change from Previous Quarter		115%	55%	28%	61%	
Cumulative Total		490	940	1,515	2,440	
ASPs: NMOS		\$75.00	\$45.00	\$35.00	\$28.00	\$39.21
CMOS		\$100.00	\$80.00	\$60.00	\$45.00	\$64.00
Overall		\$77.59	\$48.11	\$37.17	\$29.47	\$41.42
Revenue (\$M)		22.5	21.7	21.4	27.3	92.8
Market Share						
U.S.		86.2%	84.4%	82.6%	78.9%	81.9%
Japan		13.8	15.6	17.4	21.1	18.1
Europe		0	0	0	0	0
Total		100.0%	100.0%	100.0%	100.0%	100.0%

S = Sampling
N/A = Not Available

(Continued)

MOS EPROM--Data

Table 6 (Continued)

256K MOS EPROM Shipment Data, 1983-1987

Company	MOS Process	1985				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	450	800	950	950	3,150
Atmel	N	N/A	N/A	N/A	S	0
	C	N/A	N/A	N/A	S	0
Fujitsu	N	25	200	400	650	1,275
	C	150	250	400	600	1,400
General Instrument	N	N/A	N/A	S	25	25
	C	N/A	N/A	S	10	10
Hitachi	N	50	200	500	800	1,550
	C	S	25	150	300	475
Intel	N	1,000	1,800	2,400	2,700	7,900
	C	N/A	S	50	100	150
Mitsubishi	N	5	25	70	600	700
National Semi.	C	S	S	S	10	10
NEC	N	30	230	550	750	1,560
	C	S	50	150	200	400
SEEQ	C	15	110	180	250	555
Seiko-Epson	C	N/A	N/A	N/A	S	0
SGS	N	N/A	N/A	S	10	10
Texas Instruments	C	N/A	N/A	S	50	50
Toshiba	N	150	350	550	700	1,750
	C	150	200	300	425	1,075
VLSI Technology	C	N/A	S	25	50	75
WaferScale	C	N/A	N/A	S	S	0
	N	1,710	3,605	5,420	7,185	17,920
	C	315	635	1,255	1,995	4,200
Total		2,025	4,240	6,675	9,180	22,120
Percentage Change from Previous Quarter		350%	109%	57%	38%	
Cumulative Total		4,465	8,705	15,380	24,560	
ASPs: NMOS		\$20.00	\$12.00	\$5.30	\$4.25	\$7.63
CMOS		\$30.00	\$13.50	\$7.00	\$6.00	\$9.23
Overall		\$21.56	\$12.22	\$5.62	\$4.63	\$7.93
Revenue (\$M)		43.7	51.8	37.5	42.5	175.5
Market Share		1985				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
U.S.		72.3%	63.9%	54.0%	45.2%	53.9%
Japan		27.7	36.1	46.0	54.7	46.0
Europe		0	0	0	0.1	0
Total		100.0%	100.0%	100.0%	100.0%	100.0%

S = Sampling

N/A = Not Available

Note: Columns may not add to totals shown because of rounding.

(Continued)

MOS EPROM--Data

Table 6 (Continued)

256K MOS EPROM Shipment Data, 1983-1987

Company	MOS Process	1986				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	700	1,000	1,050	1,000	3,750
Atmel	N	0	0	0	0	0
	C	0	0	0	0	0
Fujitsu	N	500	500	500	600	2,100
	C	200	250	250	400	1,100
General Instrument	N	908	600	545	500	2,553
	C	112	317	493	500	1,422
Hitachi	C OTP	35	85	10	200	330
	N	950	1,100	1,350	1,500	4,900
	C	350	500	650	800	2,300
Intel	C OTP	0	0	0	0	0
	N	3,300	4,000	4,200	4,000	15,500
	C	150	175	450	550	1,325
	N OTP	200	250	280	300	1,030
Mitsubishi	N	1,637	2,096	1,776	935	6,444
	C	0	0	19	157	176
	N OTP	1,249	1,480	1,435	3,435	7,599
	C OTP	0	0	0	0	0
National Semi.	C	25	100	250	300	675
NEC	N	1,230	1,250	990	500	3,970
	C	1,620	1,220	1,140	800	4,780
Oki Electric	N	N/A	S	0	30	30
Ricoh	C	0	0	5	5	10
SEEG	C	70	70	40	40	220
Seiko-Epson	C	0	5	10	10	25
SGS	N	6	136	10	10	162
Signetics	C	S	S	5	15	20
Texas Instrument	C	125	200	225	800	1,350
Toshiba	N	600	800	800	800	3,000
	C	300	400	400	400	1,500
	N OTP	300	500	800	1,200	2,800
	C OTP	100	200	200	200	700
VLSI Technology	C	50	50	50	50	200
WaferScale	C	S	5	5	5	15
Others	N	0	0	0	0	0
	C	5	5	5	5	20
	N	11,580	13,712	13,736	14,810	53,838
	C	3,142	3,582	4,207	5,237	16,168
Total		14,722	17,294	17,943	20,047	70,006

(Continued)

MOS EPROM--Data

Table 6 (Continued)

256K MOS EPROM Shipment Data, 1983-1987

		1986				
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Year
Percentage Change from Previous Quarter		60%	17%	4%	12%	
Cumulative Total		39,282	56,576	74,519	94,566	
ASPs:	NMOS	\$4.14	\$4.50	\$4.50	\$4.20	\$4.34
	CMOS	\$5.00	\$5.50	\$5.50	\$5.25	\$5.32
	Overall	\$4.32	\$4.71	\$4.73	\$4.47	\$4.57
Revenue (\$M)		63.7	81.4	85.0	89.7	319.7

		1986				
		1st	2nd	3rd	4th	
		Qtr.	Qtr.	Qtr.	Qtr.	Year
Market Share						
U.S.		38.6%	39.6%	42.4%	41.2%	40.6%
Japan		61.4	59.6	57.5	58.7	59.2
Europe		<u>0.0</u>	<u>0.8</u>	<u>0.1</u>	<u>0.0</u>	<u>0.2</u>
Total		100.0%	100.0%	100.0%	100.0%	100.0%

S = Sampling

N/A = Not Available

Columns may not add to totals shown because of rounding.

(Continued)

MOS EPROM--Data

Table 6 (Continued)

256K MOS EPROM Shipment Data, 1983-1987

Company	MOS Process	1987				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	1,585	1,850	1,600	1,860	6,895
	C	0	10	100	215	325
Fujitsu	N	900	800	950	900	3,550
	C	700	1,700	2,050	2,500	6,950
Hitachi	N	2,500	2,500	1,600	0	6,600
	C	2,200	2,000	2,000	0	6,200
Intel	C OTP	0	0	0	0	0
	N	4,500	5,400	4,300	4,600	18,800
Microchip Tech., Inc.	C	450	500	370	260	1,580
	N OTP	800	1,200	1,000	950	3,950
Mitsubishi	C OTP	100	50	250	170	570
	N	600	700	700	800	2,800
Mitsubishi	C	900	1,000	1,000	300	3,200
	OTP	200	200	400	100	900
National Semi. NEC	N	1,300	1,800	2,200	1,750	7,050
	C	400	500	750	800	2,450
Oki Electric	N OTP	950	450	800	400	2,600
	C	0	0	20	60	80
Ricoh	C	654	1,257	1,606	3,510	7,027
	N	690	540	360	400	1,990
Seiko-Epson	C	1,090	870	1,600	1,250	4,810
	N	100	100	100	50	350
SGS-Thomson	N OTP	800	800	800	800	3,200
	C	5	5	10	20	40
Signetics	C	75	75	75	75	300
	N	20	20	20	10	70
Texas Instrument	C	840	1,160	1,170	1,600	4,770
	N	200	250	400	500	1,350
Toshiba	C	1,300	1,400	1,500	1,700	5,900
	N	800	800	1,000	1,500	4,100
VLSI Technology	C	500	800	1,200	1,000	3,500
	N OTP	1,400	1,500	1,000	1,000	4,900
WaferScale	C	200	400	400	400	1,400
	C	25	30	30	50	135
Total	C	17,765	19,600	17,580	16,610	71,555
	N	15	20	20	30	85
Total	C	9,034	11,087	13,801	12,950	46,872
	N	26,799	30,687	31,381	29,560	118,427

(Continued)

MOS EPROM--Data

Table 6 (Continued)

256K MOS EPROM Shipment Data, 1983-1987

	1987				<u>Year</u>
	<u>1st</u> <u>Qtr.</u>	<u>2nd</u> <u>Qtr.</u>	<u>3rd</u> <u>Qtr.</u>	<u>4th</u> <u>Qtr.</u>	
Percentage Change from Previous Quarter	34%	15%	2%	(6%)	
Cumulative Total	121,365	152,052	183,433	212,993	
ASPs: NMOS	\$4.25	\$4.35	\$4.40	\$4.45	\$4.36
CMOS	\$4.90	\$5.00	\$5.10	\$5.10	\$5.04
Overall	\$4.47	\$4.59	\$4.71	\$4.73	\$4.63
Revenue (\$M)	119.8	140.7	147.7	140.0	548.2
	1987				<u>Year</u>
	<u>1st</u> <u>Qtr.</u>	<u>2nd</u> <u>Qtr.</u>	<u>3rd</u> <u>Qtr.</u>	<u>4th</u> <u>Qtr.</u>	
Market Share					
U.S.	41.8%	44.6%	41.3%	49.5%	44.3%
Japan	54.3	50.8	53.7	43.4	50.5
Europe	3.9	4.6	5.0	7.1	5.2
Total	100.0%	100.0%	100.0%	100.0%	100.0%

S = Sampling

N/A = Not Available

Columns may not add to totals shown because of rounding.

Source: Dataquest
May 1989

MOS EPROM--Data

Table 7

512K MOS EPROM Shipment Data, 1984-1987

Company	MOS Process	1984				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	S	2	2	4	8
Fujitsu	N	N/A	N/A	N/A	N/A	0
General Instrument	C	N/A	N/A	N/A	N/A	0
Hitachi	N	N/A	N/A	N/A	N/A	0
	C	N/A	N/A	N/A	N/A	0
Intel	N	N/A	S	2	6	8
Mitsubishi	N	N/A	N/A	N/A	N/A	0
Toshiba	N	N/A	N/A	N/A	N/A	0
	C	N/A	N/A	N/A	N/A	0
VLSI Technology	C	N/A	N/A	N/A	N/A	0
WaferScale	C	N/A	N/A	N/A	N/A	0
	N	0	2	4	10	16
	C	0	0	0	0	0
Total		0	2	4	10	16

Percentage Change from
Previous Quarter

0 0 100% 150%

Cumulative Total

0 2 6 16

ASPs:

NMOS

\$250.00 \$150.00 \$120.30 \$95.00 \$108.13

CMOS

0 0 0 0 0

Overall

\$250.00 \$150.00 \$120.00 \$95.00 \$108.13

Revenue (\$M)

0 0.3 0.5 1.0 1.7

	1984				Year
	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
Market Share					
U.S.	0	100.0%	100.0%	100.0%	100.0%
Japan	0	0	0	0	0
Europe	0	0	0	0	0
Total	0	100.0%	100.0%	100.0%	100.0%

S = Sampling

N/A = Not Available

(Continued)

MOS EPROM--Data

Table 7 (Continued)

512K MOS EPROM Shipment Data, 1984-1987

Company	MOS Process	1985				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	12	30	35	75	152
Fujitsu	N	N/A	N/A	S	10	10
General Instrument	C	N/A	N/A	N/A	N/A	0
Hitachi	N	N/A	N/A	S	15	15
	C	N/A	N/A	N/A	N/A	0
Intel	N	15	50	65	135	265
Mitsubishi	N	N/A	N/A	N/A	N/A	0
Toshiba	N	N/A	N/A	N/A	S	0
	C	N/A	N/A	N/A	N/A	0
VLSI Technology	C	N/A	N/A	N/A	N/A	0
WaferScale	C	N/A	N/A	N/A	N/A	0
	N	27	80	100	225	432
	C	0	0	0	10	10
Total		27	80	100	235	442
Percentage Change from Previous Quarter						
		170%	196%	25%	135%	
Cumulative Total						
		43	123	223	458	
ASPs: NMOS						
		\$80.00	\$50.00	\$30.00	\$22.00	\$32.66
CMOS						
		0	0	\$45.00	\$25.00	\$25.00
Overall						
		\$80.00	\$50.00	\$30.00	\$22.13	\$32.49
Revenue (\$M)						
		2.2	4.0	3.0	5.2	14.4
Market Share						
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Year
U.S.		100.0%	100.0%	100.0%	89.4%	94.3%
Japan		0	0	0	10.6	5.7
Europe		0	0	0	0	0
Total		100.0%	100.0%	100.0%	100.0%	100.0%

S = Sampling
N/A = Not Available

(Continued)

MOS EPROM--Data

Table 7 (Continued)

512K MOS EPROM Shipment Data, 1984-1987

Company	MOS Process	1986				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	175	280	540	400	1,395
Fujitsu	C	25	25	25	25	100
General Instrument	C	S	10	25	100	135
	OTP	N/A	N/A	S	S	5
Hitachi	N	N/A	S	60	300	360
	C	N/A	N/A	N/A	N/A	0
Intel	N	250	400	730	900	2,280
Mitsubishi	N	N/A	S	58	365	423
National Semi.	C	N/A	S	0	0	0
Oki Electric	N	N/A	N/A	S	S	0
Texas Instruments	C	N/A	N/A	S	50	50
Toshiba	N	50	150	300	400	900
	OTP	N/A	N/A	S	30	30
VLSI Technology	C	8	0	3	5	8
WaferScale	C	N/A	N/A	N/A	N/A	0
Others	C	S	S	S	S	15
	N	475	830	1,688	2,395	5,388
	C	25	40	58	190	313
Total		500	870	1,746	2,585	5,701
Percentage Change from Previous Quarter						
		113%	74%	101%	48%	
Cumulative Total						
		958	1,828	3,574	6,159	
ASPs: NMOS						
		\$14.00	\$12.00	\$12.00	\$11.00	\$11.73
CMOS						
		\$16.50	\$15.50	\$15.00	\$13.00	\$13.97
Overall						
		\$14.13	\$12.16	\$12.10	\$11.15	\$11.85
Revenue (\$M)						
		7.1	10.6	21.1	28.8	67.6
Market Share						
U.S.		85.0%	79.9%	74.6%	56.7%	68.2%
Japan		15.0	20.1	25.4	43.3	31.8
Europe		0	0	0	0	0
Total		100.0%	100.0%	100.0%	100.0%	100.0%

S = Sampling
N/A = Not Available

(Continued)

MOS EPROM--Data

Table 7 (Continued)

512K MOS EPROM Shipment Data, 1984-1987

Company	MOS Process	1987				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	740	785	525	605	2,655
	C	8	5	25	285	315
Fujitsu	C	500	1,500	1,800	2,100	5,900
Hitachi	N	750	800	850	950	3,350
	C	8	0	0	0	0
Intel	N	800	1,200	1,800	2,700	6,500
Microchip Tech., Inc.	C	100	150	100	120	470
	OTP	10	10	20	20	60
Mitsubishi	N	750	800	1,200	1,450	4,200
National Semi.	C	0	0	0	0	0
NEC	C	N/A	8	0	1,050	1,050
Ok! Electric	N	0	180	200	400	780
	N OTP	0	170	200	650	1,020
SGS-Thomson	N	N/A	1	50	350	401
Texas Instruments	C	100	150	200	400	850
Toshiba	N	550	500	700	800	2,550
	N OTP	200	180	200	170	750
VLSI Technology	C	5	5	5	8	23
WaferScale	C	0	0	0	0	0
	N	3,790	4,616	5,725	8,075	22,206
	C	715	1,820	2,150	3,983	8,668
Total		4,505	6,436	7,875	12,058	30,874
Percentage Change from Previous Quarter						
		74%	43%	22%	53%	
Cumulative Total		10,664	17,100	24,975	37,033	
ASPs: NMOS		\$10.00	\$ 9.00	\$7.78	\$6.80	\$8.06
CMOS		\$11.00	\$10.00	\$9.00	\$7.50	\$8.69
Overall		\$10.16	\$ 9.28	\$8.11	\$7.03	\$8.23
Revenue (\$M)		45.8	59.7	63.9	84.8	254.2
Market Share						
U.S.		39.0%	35.8%	34.0%	34.3%	35.2%
Japan		61.0	64.2	65.4	62.8	63.5
Europe		0	0	0.6	2.9	1.3
Total		100.0%	100.0%	100.0%	100.0%	100.0%

S = Sampling
N/A = Not Available

Source: Dataquest
May 1989

MOS EPROM--Data

Table 8

1-Mbit MOS EPROM Shipment Data, 1986-1987

Company	MOS Process	Technology Features	1986				Year
			1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	C	x16	1	1	4	6	12
Atmel	C	N/A	0	0	0	0	0
Fujitsu	C	x8, x16	N/A	S	S	1	1
General Instrument	C	x16	N/A	N/A	N/A	N/A	0
Hitachi	C	x8, x16	S	10	30	75	115
Intel	N	x8, x16	S	5	25	30	60
Motorola	C	N/A	S	S	S	0	0
National Semi.	C	x8, x16	N/A	N/A	N/A	S	0
NBC	C	x16	N/A	S	0	1	1
Oki Electric	C	x16	N/A	N/A	N/A	S	0
Texas Instruments	C	N/A	N/A	N/A	S	S	0
Toshiba	C	x8	N/A	S	S	15	20
Other	C	N/A	N/A	N/A	S	0	0
	N		0	5	25	30	60
	C		<u>1</u>	<u>11</u>	<u>39</u>	<u>98</u>	<u>149</u>
Total			1	16	64	128	209

Percentage Change from
Previous Quarter

0 3,100% 300% 100%

Cumulative Total

1 17 81 209

ASPs: NMOS
CMOS
Overall

\$110.00 \$80.00 \$50.00 \$42.00 \$48.50
\$150.00 \$70.00 \$66.00 \$60.00 \$62.62
\$150.00 \$73.13 \$59.75 \$55.78 \$58.56

Revenue (\$M)

0.1 1.2 3.8 7.1 12.2

Market Share

U.S.

100.0% 37.5% 45.3% 28.1% 34.3%

Japan

0 62.5 54.7 71.9 65.7

Europe

0 0 0 0 0

Total

100.0% 100.0% 100.0% 100.0% 100.0%

S = Sampling

N/A = Not Available

(Continued)

MOS EPROM--Data

Table 8 (Continued)

1-Mbit MOS EPROM Shipment Data, 1986-1987

Company	MOS Process	Technology Features	1987				Year
			1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	C	x16	5	5	5	15	30
Fujitsu	C	x8, x16	N/A	5	5	10	15
Hitachi	C	x8, x16	100	70	150	250	570
Intel	N	x8, x16	50	30	80	150	310
Microchip Tech., Inc.	C		N/A	N/A	N/A	N/A	0
Mitsubishi	C	x8, x16	0	5	5	80	90
National Semi.	C	x8, x16	0	0	0	0	0
NEC	C	x8	N/A	0	50	300	350
	C	x16	N/A	0	50	100	150
Oki Electric	C	x8, x16	N/A	N/A	N/A	S	0
SGS-thomson	C		N/A	N/A	N/A	N/A	0
Texas Instruments	C		0	0	0	0	0
Toshiba	C	x8, x16	20	40	40	50	150
	N		50	30	80	150	310
	C		125	120	305	805	1,355
Total			175	150	385	955	1,655
Percentage Change from Previous Quarter			37%	(14%)	157%	148%	
Cumulative Total			384	534	919	1,874	
ASPs: NMOS			\$26.00	\$24.00	\$24.00	\$24.00	\$24.32
CMOS			\$40.00	\$32.00	\$28.00	\$26.00	\$28.27
Overall			\$36.00	\$30.40	\$27.17	\$25.69	\$27.54
Revenue (\$M)			6.3	4.6	10.5	24.5	45.9
			1987				
			1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Year
Market Share							
U.S.			31.4%	23.3%	22.1%	17.3%	20.4%
Japan			68.6	76.7	77.9	82.7	79.6
Europe			0	0	0	0	0
Total			100.0%	100.0%	100.0%	100.0%	100.0%

S = Sampling
N/A = Not Available

Source: Dataquest
May 1989

MOS EPROM--Data

QUARTERLY COMPANY MOS EPROM SHIPMENT DATA

This section contains unit shipment data on MOS EPROMs from 1976 through 1987. In addition to unit shipments for 8K, 16K, 32K, 64K, 128K, 256K, 512K, and 1-Mbit EPROMs, we have added our estimates of the worldwide billing prices for each product during the four quarters of the year. At the bottom of each table, we show market share data (units, not revenue) for companies based in the United States, Japan, and Europe. The tables are organized as follows:

- Table 1—8K MOS EPROM Shipment Data, 1976–1985
- Table 2—16K MOS EPROM Shipment Data, 1976–1987
- Table 3—32K MOS EPROM Shipment Data, 1978–1987
- Table 4—64K MOS EPROM Shipment Data, 1980–1987
- Table 5—128K MOS EPROM Shipment Data, 1982–1987
- Table 6—256K MOS EPROM Shipment Data, 1983–1987
- Table 7—512K MOS EPROM Shipment Data, 1984–1987
- Table 8—1-Mbit MOS EPROM Shipment Data, 1986–1987

Definitions

Prices

Prices are Dataquest estimates of the billing prices during each quarter. These prices are averaged over all package types, lot sizes, and the entire speed mix, and they represent sales to both military and commercial accounts.

Quarterly Revenue

Quarterly revenue is calculated as units shipped times the prevailing price during that period. We have not, at this time, reconciled the sum of the quarterly shipments by product with the top-level product or MOS memory total. Doing so would undoubtedly force some changes in units, ASPs, or both.

OTP EPROM Data

Included in the 1986 and 1987 data are OTP EPROM shipments.

MOS EPROM--Data

Table 1

8K MOS EPROM Shipment Data, 1976-1985

<u>Company</u>	<u>1976</u>				<u>Year</u>
	<u>1st</u> <u>Qtr.</u>	<u>2nd</u> <u>Qtr.</u>	<u>3rd</u> <u>Qtr.</u>	<u>4th</u> <u>Qtr.</u>	
AMD					
Electronic Arrays	N/A	N/A	N/A	S	S
Fairchild	N/A	N/A	N/A	N/A	N/A
Fujitsu	N/A	N/A	N/A	S	S
Intel	S	25	75	125	225
Mitsubishi	N/A	N/A	N/A	N/A	N/A
Motorola	N/A	N/A	N/A	N/A	N/A
National Semi.	N/A	N/A	N/A	N/A	N/A
Oki Electric	N/A	N/A	N/A	N/A	N/A
Texas Instruments	N/A	N/A	S	5	5
Toshiba	N/A	S	20	50	70
Total	S	25	95	180	300
Percentage Change from Previous Quarter	0%	0%	280%	89%	
Cumulative Total	0	25	120	300	
Average Selling Price	\$80.00	\$50.00	\$35.00	\$30.00	\$33.25
Revenue (\$M)	0	1.3	3.3	5.4	10.0
	<u>1976</u>				<u>Year</u>
	<u>1st</u> <u>Qtr.</u>	<u>2nd</u> <u>Qtr.</u>	<u>3rd</u> <u>Qtr.</u>	<u>4th</u> <u>Qtr.</u>	
Market Share					
U.S.	0	100.0%	78.9%	72.2%	76.7%
Japan	0	0	21.1	27.8	23.3
Europe	0	0	0	0	0
Total	0	100.0%	100.0%	100.0%	100.0%

N/A = Not Available

S = Sampling

(Continued)

MOS EPROM--Data

Table 1 (Continued)

8K MOS EPROM Shipment Data, 1976-1985

<u>Company</u>	<u>1977</u>				<u>Year</u>
	<u>1st</u> <u>Qtr.</u>	<u>2nd</u> <u>Qtr.</u>	<u>3rd</u> <u>Qtr.</u>	<u>4th</u> <u>Qtr.</u>	
AMD					
Electronic Arrays	10	15	50	75	150
Fairchild	0	0	0	5	5
Fujitsu	10	15	25	40	90
Intel	200	325	475	600	1,600
Mitsubishi	N/A	N/A	N/A	N/A	N/A
Motorola	S	15	20	35	70
National Semi.	S	25	40	85	150
Oki Electric	N/A	N/A	N/A	N/A	N/A
Texas Instruments	15	25	40	70	150
Toshiba	<u>100</u>	<u>100</u>	<u>200</u>	<u>300</u>	<u>700</u>
Total	335	520	850	1,210	2,915
Percentage Change from Previous Quarter	86%	55%	63%	42%	
Cumulative Total	635	1,155	2,005	3,215	
Average Selling Price	\$30.00	\$25.00	\$21.00	\$18.00	\$21.50
Revenue (\$M)	10.1	13.0	17.9	21.8	62.7
	<u>1977</u>				<u>Year</u>
	<u>1st</u> <u>Qtr.</u>	<u>2nd</u> <u>Qtr.</u>	<u>3rd</u> <u>Qtr.</u>	<u>4th</u> <u>Qtr.</u>	
Market Share					
U.S.	67.2%	77.9%	73.5%	71.9%	72.9%
Japan	32.8	22.1	26.5	28.1	27.1
Europe	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total	100.0%	100.0%	100.0%	100.0%	100.0%

N/A = Not Available
S = Sampling

(Continued)

MOS EPROM--Data

Table 1 (Continued)
8K MOS EPROM Shipment Data, 1976-1985

<u>Company</u>	<u>1978</u>				<u>Year</u>
	<u>1st</u> <u>Qtr.</u>	<u>2nd</u> <u>Qtr.</u>	<u>3rd</u> <u>Qtr.</u>	<u>4th</u> <u>Qtr.</u>	
AMD	15	50	80	340	485
Electronic Arrays	30	50	60	60	200
Fairchild	40	60	60	120	280
Fujitsu	50	90	70	70	280
Intel	700	900	800	1,000	3,400
Mitsubishi	50	125	175	250	600
Motorola	100	250	250	420	1,020
National Semi.	275	260	310	405	1,250
Oki Electric	N/A	N/A	N/A	N/A	N/A
Texas Instruments	350	550	400	800	2,100
Toshiba	<u>N/A</u>	<u>N/A</u>	<u>10</u>	<u>30</u>	<u>40</u>
Total	1,610	2,335	2,215	3,495	9,655
Percentage Change from Previous Quarter	33%	45%	(5%)	58%	.
Cumulative Total	4,825	7,160	9,375	12,870	
Average Selling Price	\$15.00	\$ 9.00	\$ 5.00	\$ 4.50	\$ 7.45
Revenue (\$M)	24.2	21.0	11.1	15.7	72.0
	<u>1978</u>				<u>Year</u>
	<u>1st</u> <u>Qtr.</u>	<u>2nd</u> <u>Qtr.</u>	<u>3rd</u> <u>Qtr.</u>	<u>4th</u> <u>Qtr.</u>	
Market Share					
U.S.	93.8%	90.8%	88.5%	90.0%	90.5%
Japan	6.2	9.2	11.5	10.0	9.5
Europe	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total	100.0%	100.0%	100.0%	100.0%	100.0%

N/A = Not Available

(Continued)

MOS EPROM--Data

Table 1 (Continued)
8K MOS EPROM Shipment Data, 1976-1985

<u>Company</u>	<u>1979</u>				<u>Year</u>
	<u>1st</u> <u>Qtr.</u>	<u>2nd</u> <u>Qtr.</u>	<u>3rd</u> <u>Qtr.</u>	<u>4th</u> <u>Qtr.</u>	
AMD	600	700	700	500	2,500
Electronic Arrays	75	100	125	35	335
Fairchild	160	200	350	600	1,310
Fujitsu	70	50	50	50	220
Intel	1,100	1,400	1,400	1,100	5,000
Mitsubishi	190	240	240	270	940
Motorola	700	750	1,000	1,000	3,450
National Semi.	600	800	800	900	3,100
Oki Electric	N/A	N/A	N/A	N/A	N/A
Texas Instruments	800	800	800	800	3,200
Toshiba	<u>50</u>	<u>100</u>	<u>100</u>	<u>50</u>	<u>300</u>
Total	4,345	5,140	5,565	5,305	20,355
Percentage Change from Previous Quarter	24%	18%	8%	(5%)	
Cumulative Total	17,215	22,355	27,920	33,225	
Average Selling Price	\$6.00	\$8.00	\$7.00	\$5.50	\$6.65
Revenue (\$M)	26.1	41.1	39.0	29.2	135.3
	<u>1979</u>				<u>Year</u>
	<u>1st</u> <u>Qtr.</u>	<u>2nd</u> <u>Qtr.</u>	<u>3rd</u> <u>Qtr.</u>	<u>4th</u> <u>Qtr.</u>	
Market Share					
U.S.	92.9%	92.4%	93.0%	93.0%	92.8%
Japan	7.1	7.6	7.0	7.0	7.2
Europe	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total	100.0%	100.0%	100.0%	100.0%	100.0%

N/A = Not Available

(Continued)

MOS EPROM--Data

Table 1 (Continued)

8K MOS EPROM Shipment Data, 1976-1985

<u>Company</u>	<u>1980</u>				<u>Year</u>
	<u>1st</u> <u>Qtr.</u>	<u>2nd</u> <u>Qtr.</u>	<u>3rd</u> <u>Qtr.</u>	<u>4th</u> <u>Qtr.</u>	
AMD	600	700	650	350	2,300
Electronic Arrays	0	0	0	0	0
Fairchild	750	1,000	850	600	3,200
Fujitsu	50	50	50	50	200
Intel	700	500	500	250	1,950
Mitsubishi	160	60	90	80	390
Motorola	500	500	350	250	1,600
National Semi.	1,000	1,000	700	600	3,300
Oki Electric	N/A	N/A	N/A	S	N/A
Texas Instruments	800	600	600	580	2,580
Toshiba	<u>35</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>35</u>
Total	4,595	4,410	3,790	2,760	15,555
Percentage Change from Previous Quarter	(13%)	(4%)	(14%)	(27%)	
Cumulative Total	37,820	42,230	46,020	48,780	
Average Selling Price	\$5.00	\$4.50	\$4.50	\$3.00	\$4.38
Revenue (\$M)	23.0	19.8	17.1	8.3	68.2
	<u>1980</u>				<u>Year</u>
	<u>1st</u> <u>Qtr.</u>	<u>2nd</u> <u>Qtr.</u>	<u>3rd</u> <u>Qtr.</u>	<u>4th</u> <u>Qtr.</u>	
Market Share					
U.S.	94.7%	97.5%	96.3%	95.3%	96.0%
Japan	5.3	2.5	3.7	4.7	4.0
Europe	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total	100.0%	100.0%	100.0%	100.0%	100.0%

N/A = Not Available

S = Sampling

(Continued)

MOS EPROM--Data

Table 1 (Continued)
8K MOS EPROM Shipment Data, 1976-1985

<u>Company</u>	<u>1981</u>				<u>Year</u>
	<u>1st</u> <u>Qtr.</u>	<u>2nd</u> <u>Qtr.</u>	<u>3rd</u> <u>Qtr.</u>	<u>4th</u> <u>Qtr.</u>	
AMD	500	200	200	190	1,090
Electronic Arrays	0	0	0	0	0
Fairchild	300	240	150	50	740
Fujitsu	50	20	10	0	80
Intel	200	150	100	50	500
Mitsubishi	110	40	30	25	205
Motorola	150	175	150	220	695
National Semi.	400	350	200	100	1,050
Oki Electric	50	50	70	50	220
Texas Instruments	550	400	300	200	1,450
Toshiba	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total	2,310	1,625	1,210	885	6,030
Percentage Change from Previous Quarter	(16%)	(30%)	(26%)	(27%)	
Cumulative Total	51,090	52,715	53,925	54,810	
Average Selling Price	\$3.50	\$3.00	\$2.50	\$2.00	\$2.94
Revenue (\$M)	8.1	4.9	3.0	1.8	17.8
	<u>1981</u>				<u>Year</u>
	<u>1st</u> <u>Qtr.</u>	<u>2nd</u> <u>Qtr.</u>	<u>3rd</u> <u>Qtr.</u>	<u>4th</u> <u>Qtr.</u>	
Market Share					
U.S.	90.9%	93.2%	90.9%	91.5%	91.6%
Japan	9.1	6.8	9.1	8.5	8.4
Europe	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total	100.0%	100.0%	100.0%	100.0%	100.0%

(Continued)

MOS EPROM--Data

Table 1 (Continued)

8K MOS EPROM Shipment Data, 1976-1985

<u>Company</u>	<u>1982</u>				<u>Year</u>
	<u>1st</u> <u>Qtr.</u>	<u>2nd</u> <u>Qtr.</u>	<u>3rd</u> <u>Qtr.</u>	<u>4th</u> <u>Qtr.</u>	
AMD	180	100	100	50	430
Electronic Arrays	0	0	0	0	0
Fairchild	30	5	0	0	35
Fujitsu	0	0	0	0	0
Intel	15	5	0	0	20
Mitsubishi	20	15	30	0	65
Motorola	200	160	250	150	760
National Semi.	70	50	50	50	220
Oki Electric	30	25	15	25	95
Texas Instruments	100	70	35	25	230
Toshiba	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total	645	430	480	300	1,855
Percentage Change from Previous Quarter	(27%)	(33%)	12%	(38%)	
Cumulative Total	55,455	55,885	56,365	56,665	
Average Selling Price	\$3.50	\$3.50	\$3.25	\$3.25	\$3.39
Revenue (\$M)	2.3	1.5	1.6	1.0	6.3
	<u>1982</u>				<u>Year</u>
	<u>1st</u> <u>Qtr.</u>	<u>2nd</u> <u>Qtr.</u>	<u>3rd</u> <u>Qtr.</u>	<u>4th</u> <u>Qtr.</u>	
Market Share					
U.S.	92.2%	90.7%	90.6%	91.7%	91.4%
Japan	7.8	9.3	9.4	8.3	8.6
Europe	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total	100.0%	100.0%	100.0%	100.0%	100.0%

(Continued)

MOS EPROM--Data

Table 1 (Continued)

8K MOS EPROM Shipment Data, 1976-1985

<u>Company</u>	<u>1983</u>				<u>Year</u>
	<u>1st</u> <u>Qtr.</u>	<u>2nd</u> <u>Qtr.</u>	<u>3rd</u> <u>Qtr.</u>	<u>4th</u> <u>Qtr.</u>	
AMD	100	100	50	50	300
Electronic Arrays	0	0	0	0	0
Fairchild	0	0	0	0	0
Fujitsu	0	0	0	0	0
Intel	0	0	0	0	0
Mitsubishi	0	0	0	0	0
Motorola	120	100	70	0	290
National Semi.	50	50	25	25	150
Oki Electric	0	0	0	0	0
Texas Instruments	0	0	0	0	0
Toshiba	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total	270	250	145	75	740
Percentage Change from Previous Quarter	(10%)	(7%)	(42%)	(48%)	
Cumulative Total	56,935	57,185	57,330	57,405	
Average Selling Price	\$3.50	\$4.00	\$4.00	\$4.25	\$3.84
Revenue (\$M)	0.9	1.0	0.6	0.3	2.8
	<u>1983</u>				<u>Year</u>
	<u>1st</u> <u>Qtr.</u>	<u>2nd</u> <u>Qtr.</u>	<u>3rd</u> <u>Qtr.</u>	<u>4th</u> <u>Qtr.</u>	
Market Share					
U.S.	100.0%	100.0%	100.0%	100.0%	100.0%
Japan	0	0	0	0	0
Europe	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total	100.0%	100.0%	100.0%	100.0%	100.0%

(Continued)

MOS EPROM--Data

Table 1 (Continued)

8K MOS EPROM Shipment Data, 1976-1985

<u>Company</u>	<u>1984</u>				<u>Year</u>
	<u>1st</u> <u>Qtr.</u>	<u>2nd</u> <u>Qtr.</u>	<u>3rd</u> <u>Qtr.</u>	<u>4th</u> <u>Qtr.</u>	
AMD	80	130	30	20	260
Electronic Arrays	0	0	0	0	0
Fairchild	0	0	0	0	0
Fujitsu	0	0	0	0	0
Intel	0	0	0	0	0
Mitsubishi	0	0	0	0	0
Motorola	0	0	0	0	0
National Semi.	25	0	0	0	25
Oki Electric	0	0	0	0	0
Texas Instruments	0	0	0	0	0
Toshiba	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total	105	130	30	20	285
Percentage Change from Previous Quarter	40%	24%	(77%)	(33%)	
Cumulative Total	57,510	57,640	57,670	57,690	
Average Selling Price	\$4.00	\$4.00	\$4.00	\$5.00	\$4.07
Revenue (\$M)	0.4	0.5	0.1	0.1	1.2
	<u>1984</u>				<u>Year</u>
	<u>1st</u> <u>Qtr.</u>	<u>2nd</u> <u>Qtr.</u>	<u>3rd</u> <u>Qtr.</u>	<u>4th</u> <u>Qtr.</u>	
Market Share					
U.S.	100.0%	100.0%	100.0%	100.0%	100.0%
Japan	0	0	0	0	0
Europe	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total	100.0%	100.0%	100.0%	100.0%	100.0%

(Continued)

MOS EPROM--Data

Table 1 (Continued)
8K MOS EPROM Shipment Data, 1976-1985

<u>Company</u>	<u>1985</u>				<u>Year</u>
	<u>1st</u> <u>Qtr.</u>	<u>2nd</u> <u>Qtr.</u>	<u>3rd</u> <u>Qtr.</u>	<u>4th</u> <u>Qtr.</u>	
AMD	15	10	5	5	35
Electronic Arrays	0	0	0	0	0
Fairchild	0	0	0	0	0
Fujitsu	0	0	0	0	0
Intel	0	0	0	0	0
Mitsubishi	0	0	0	0	0
Motorola	0	0	0	0	0
National Semi.	0	0	0	0	0
Oki Electric	0	0	0	0	0
Texas Instruments	0	0	0	0	0
Toshiba	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total	15	10	5	5	35
Percentage Change from Previous Quarter	(25%)	(33%)	(50%)	0%	
Cumulative Total	57,705	57,715	57,720	57,725	
Average Selling Price	\$5.50	\$6.00	\$7.00	\$8.00	\$6.21
Revenue (\$M)	0.1	0.1	0	0	0.2
	<u>1985</u>				<u>Year</u>
	<u>1st</u> <u>Qtr.</u>	<u>2nd</u> <u>Qtr.</u>	<u>3rd</u> <u>Qtr.</u>	<u>4th</u> <u>Qtr.</u>	
Market Share					
U.S.	100.0%	100.0%	100.0%	100.0%	100.0%
Japan	0	0	0	0	0
Europe	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total	100.0%	100.0%	100.0%	100.0%	100.0%

Source: Dataquest
April 1988

MOS EPROM--Data

Table 2

16K MOS EPROM Shipment Data, 1976-1987

Company	MOS Process	1976				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	N/A	N/A	N/A	N/A	N/A
Burrotechnique	C	N/A	N/A	N/A	N/A	N/A
Fairchild	N	N/A	N/A	N/A	N/A	N/A
Fujitsu	N	N/A	N/A	N/A	N/A	N/A
Hitachi	N	N/A	N/A	N/A	N/A	N/A
Intel	N	N/A	N/A	S	10	10
Matsushita	N	N/A	N/A	N/A	N/A	N/A
Mitsubishi	N	N/A	N/A	N/A	N/A	N/A
Mostek	N	N/A	N/A	N/A	N/A	N/A
Motorola	N	N/A	N/A	N/A	N/A	N/A
National Semi.	N	N/A	N/A	N/A	N/A	N/A
	C	N/A	N/A	N/A	N/A	N/A
NBC	N	N/A	N/A	N/A	N/A	N/A
Oki Electric	N	N/A	N/A	N/A	N/A	N/A
SGS-Ates	N	N/A	N/A	N/A	N/A	N/A
Synertek	N	N/A	N/A	N/A	N/A	N/A
Texas Instruments	N	N/A	N/A	N/A	5	5
Toshiba	N	N/A	N/A	N/A	N/A	N/A
	N	0	0	0	15	15
	C	0	0	0	0	0
Total		0	0	0	15	15
Percentage Change from Previous Quarter						
Cumulative Total		0	0	0	15	
ASPs:						
NMOS		\$50.00	\$50.00	\$50.00	\$50.00	\$50.00
CMOS		0	0	0	0	0
Overall		\$50.00	\$50.00	\$50.00	\$50.00	\$50.00
Revenue (\$M)		0	0	0	0.8	0.8
1976						
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Year
Market Share						
U.S.		0	0	0	100.0%	100.0%
Japan		0	0	0	0	0
Europe		0	0	0	0	0
Total		0	0	0	100.0%	100.0%

S = Sampling
N/A = Not Available

(Continued)

MOS EPROM--Data

Table 2 (Continued)

16K MOS EPROM Shipment Data, 1976-1987

Company	MOS Process	1977				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	N/A	N/A	N/A	N/A	N/A
Eurotechnique	C	N/A	N/A	N/A	N/A	N/A
Fairchild	N	N/A	N/A	N/A	N/A	N/A
Fujitsu	N	N/A	N/A	N/A	N/A	N/A
Hitachi	N	N/A	N/A	N/A	N/A	N/A
Intel	N	40	75	100	125	340
Matsushita	N	N/A	N/A	N/A	N/A	N/A
Mitsubishi	N	N/A	N/A	N/A	N/A	N/A
Mostek	N	N/A	N/A	N/A	N/A	N/A
Motorola	N	N/A	N/A	N/A	N/A	N/A
National Semi.	N	N/A	N/A	N/A	N/A	N/A
NEC	C	N/A	N/A	N/A	N/A	N/A
Oni Electric	N	N/A	N/A	N/A	N/A	N/A
SGS-Ates	N	N/A	N/A	N/A	N/A	N/A
Synertek	N	N/A	N/A	N/A	N/A	N/A
Texas Instruments	N	20	25	30	55	130
Toshiba	N	N/A	N/A	N/A	N/A	N/A
	N	60	100	130	180	470
	C	0	0	0	0	0
Total		60	100	130	180	470
Percentage Change from Previous Quarter						
		0	67%	30%	38%	
Cumulative Total						
		75	175	305	485	
ASPs: NMOS						
		\$45.00	\$45.00	\$30.00	\$30.00	\$35.11
CMOS						
		0	0	0	0	0
Overall						
		\$45.00	\$45.00	\$30.00	\$30.00	\$35.11
Revenue (\$M)						
		2.7	4.5	3.9	5.4	16.5
Market Share						
		100.0%	100.0%	100.0%	100.0%	100.0%
U.S.						
		0	0	0	0	0
Japan						
		0	0	0	0	0
Europe						
		0	0	0	0	0
Total		100.0%	100.0%	100.0%	100.0%	100.0%

N/A = Not Available

(Continued)

MOS EPROM--Data

Table 2 (Continued)

16K MOS EPROM Shipment Data, 1976-1987

Company	MOS Process	1978				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	N/A	N/A	N/A	N/A	0
Eurotechnique	C	N/A	N/A	N/A	N/A	0
Fairchild	N	N/A	N/A	N/A	N/A	0
Fujitsu	N	N/A	N/A	N/A	5	5
Hitachi	N	N/A	N/A	5	30	35
Intel	N	250	400	250	450	1,350
Matsushita	N	N/A	N/A	N/A	N/A	0
Mitsubishi	N	N/A	N/A	N/A	N/A	0
Mostek	N	S	S	S	25	25
Motorola	N	N/A	S	10	90	100
National Semi.	N	N/A	N/A	S	S	0
NEC	C	N/A	N/A	N/A	N/A	0
NEC	N	N/A	N/A	N/A	N/A	0
Oki Electric	N	N/A	N/A	N/A	N/A	0
SGS-Ates	N	N/A	N/A	N/A	N/A	0
Synertek	N	N/A	N/A	N/A	N/A	0
Texas Instruments	N	100	250	200	300	850
Toshiba	N	N/A	N/A	S	5	5
	N	350	650	465	905	2,370
	C	0	0	0	0	0
Total		350	650	465	905	2,370
Percentage Change from Previous Quarter						
		94%	86%	(28%)	95%	
Cumulative Total						
		835	1,485	1,950	2,855	
ASPs: NMOS						
		\$28.00	\$25.00	\$25.00	\$15.00	\$21.62
CMOS						
		0	0	0	0	0
Overall						
		\$28.00	\$25.00	\$25.00	\$15.00	\$21.62
Revenue (\$M)						
		9.8	16.3	11.6	13.6	51.3
Market Share						
		100.0%	100.0%	98.9%	95.6%	98.1%
U.S.						
		0	0	1.1	4.4	1.9
Japan						
		0	0	0	0	0
Europe						
		0	0	0	0	0
Total		100.0%	100.0%	100.0%	100.0%	100.0%

S = Sampling
N/A = Not Available

(Continued)

MOS EPROM--Data

Table 2 (Continued)

16K MOS EPROM Shipment Data, 1976-1987

Company	MOS Process	1979				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	N/A	S	5	10	15
Eurotechnique	C	N/A	N/A	N/A	N/A	0
Fairchild	N	N/A	N/A	N/A	N/A	0
Fujitsu	N	70	200	300	300	870
Hitachi	N	125	200	350	500	1,175
Intel	N	550	750	800	900	3,000
Matsushita	N	N/A	N/A	N/A	N/A	0
Mitsubishi	N	10	20	50	90	170
Mostek	N	90	150	250	350	840
Motorola	N	160	150	160	200	670
National Semi.	N	5	50	80	120	255
	C	N/A	N/A	N/A	N/A	0
NEC	N	N/A	N/A	N/A	5	5
Oki Electric	N	N/A	N/A	N/A	N/A	0
SGS-Ates	N	N/A	N/A	N/A	N/A	0
Synertek	N	N/A	N/A	N/A	S	0
Texas Instruments	N	400	900	1,100	1,800	4,200
Toshiba	N	25	50	90	200	365
	N	1,435	2,470	3,185	4,475	11,565
	C	0	0	0	0	0
Total		1,435	2,470	3,185	4,475	11,565
Percentage Change from Previous Quarter		59%	72%	29%	41%	
Cumulative Total		4,290	6,760	9,945	14,420	
ASPs: NMOS		\$17.00	\$22.00	\$19.00	\$17.00	\$18.62
CMOS		0	0	0	0	0
Overall		\$17.00	\$22.00	\$19.00	\$17.00	\$18.62
Revenue (\$M)		24.4	54.3	60.5	76.1	215.3
Market Share		1979				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
U.S.		84.0%	81.0%	75.2%	75.5%	77.6%
Japan		16.0	19.0	24.8	24.5	22.4
Europe		0	0	0	0	0
Total		100.0%	100.0%	100.0%	100.0%	100.0%

S = Sampling
N/A = Not Available

(Continued)

MOS EPROM--Data

Table 2 (Continued)

16K MOS EPROM Shipment Data, 1976-1987

Company	MOS Process	1980				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	25	50	100	175	350
Eurotechnique	C	N/A	N/A	N/A	N/A	0
Fairchild	N	30	300	300	250	880
Fujitsu	N	350	750	700	650	2,450
Hitachi	N	700	850	1,025	1,325	3,900
Intel	N	950	1,000	1,700	1,850	5,500
Matsushita	N	S	50	50	80	180
Mitsubishi	N	210	260	270	410	1,150
Mostek	N	275	250	350	450	1,325
Motorola	N	250	350	500	500	1,600
National Semi.	N	250	250	300	425	1,225
	C	N/A	N/A	N/A	N/A	0
NEC	N	10	25	50	125	210
Oki Electric	N	S	0	0	0	0
SGS-Ates	N	1,800	0	0	5	1,805
Synertek	N	200	25	10	0	235
Texas Instruments	N	2,000	2,000	2,000	2,100	8,100
Toshiba	N	300	330	350	400	1,380
	N	7,350	6,490	7,705	8,745	30,290
	C	0	0	0	0	0
Total		7,350	6,490	7,705	8,745	30,290
Percentage Change from Previous Quarter						
		64%	(12%)	19%	13%	
Cumulative Total		21,770	28,260	35,965	44,710	
ASPs: NMOS		\$15.00	\$11.00	\$8.00	\$6.00	\$9.76
CMOS		0	0	0	0	0
Overall		\$15.00	\$11.00	\$8.00	\$6.00	\$9.76
Revenue (\$M)		110.3	71.4	61.6	52.5	295.8
Market Share						
U.S.		54.1%	65.1%	68.3%	65.8%	63.4%
Japan		21.4	34.9	31.7	34.2	30.6
Europe		24.5	0	0	0.1	6.0
Total		100.0%	100.0%	100.0%	100.0%	100.0%

S = Sampling
N/A = Not Available

(Continued)

MOS EPROM--Data

Table 2 (Continued)

16K MOS EPROM Shipment Data, 1976-1987

Company	MOS Process	1981				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	250	350	485	750	1,835
Eurotechnique	C	N/A	N/A	S	15	15
Fairchild	N	100	20	20	0	140
Fujitsu	N	750	1,000	700	500	2,950
Hitachi	N	1,700	1,700	1,200	700	5,300
Intel	N	2,600	3,000	3,000	3,000	11,600
Matsushita	N	120	150	200	250	720
Mitsubishi	N	580	740	670	520	2,510
Mostek	N	700	600	700	800	2,800
Motorola	N	400	420	500	400	1,720
National Semi.	N	500	550	700	1,100	2,850
	C	N/A	N/A	N/A	N/A	N/A
NBC	N	175	250	600	900	1,925
Oki Electric	N	25	40	80	100	245
SGS-Ates	N	15	25	50	75	165
Synertek	N	0	0	0	0	0
Texas Instruments	N	2,200	2,500	2,200	2,200	9,100
Toshiba	N	90	100	200	350	740
	N	10,205	11,445	11,305	11,645	44,600
	C	0	0	0	15	15
Total		10,205	11,445	11,305	11,660	44,615
Percentage Change from Previous Quarter						
		17%	12%	(1%)	3%	
Cumulative Total		54,915	66,360	77,665	89,325	
ASPs: NMOS		\$4.50	\$3.50	\$3.00	\$2.50	\$3.34
CMOS		0	0	0	0	0
Overall		\$4.50	\$3.50	\$3.00	\$2.50	\$3.34
Revenue (\$M)		45.9	40.1	33.9	29.1	149.0
Market Share						
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Year
U.S.		66.1%	65.0%	67.3%	70.8%	67.3%
Japan		33.7	34.8	32.3	28.5	32.3
Europe		0.1	0.2	0.4	0.8	0.4
Total		100.0%	100.0%	100.0%	100.0%	100.0%

S = Sampling
N/A = Not Available

(Continued)

MOS EPROM--Data

Table 2 (Continued)

16K MOS EPROM Shipment Data, 1976-1987

Company	MOS Process	1982				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	1,000	1,150	1,150	900	4,200
Eurotechnique	C	100	400	500	600	1,600
Fairchild	N	0	0	0	0	0
Fujitsu	N	400	350	250	100	1,100
Hitachi	N	450	250	200	200	1,100
Intel	N	3,000	2,500	1,800	1,200	8,500
Matsushita	N	250	250	150	100	750
Mitsubishi	N	450	350	300	160	1,260
Mostek	N	500	200	250	250	1,200
Motorola	N	250	160	100	60	570
National Semi.	N	1,200	1,250	1,300	2,200	5,950
	C	50	150	200	200	600
NEC	N	900	1,000	1,200	1,200	4,300
Oki Electric	N	250	400	400	400	1,450
SGS-Ates	N	100	180	350	520	1,150
Synertek	N	0	0	0	0	0
Texas Instruments	N	2,000	2,000	1,800	1,800	7,600
Toshiba	N	500	400	300	300	1,500
	N	11,250	10,440	9,550	9,390	40,630
	C	150	550	700	800	2,200
Total		11,400	10,990	10,250	10,190	42,830
Percentage Change from Previous Quarter						
		(28)	(44)	(74)	(18)	
Cumulative Total		100,725	111,715	121,965	132,155	
ASPs:						
NMOS		\$3.25	\$3.10	\$3.00	\$3.00	\$3.09
CMOS		0	0	0	0	0
Overall		\$3.25	\$3.10	\$3.00	\$3.00	\$3.09
Revenue (\$M)		36.6	32.4	28.7	28.2	125.7
Market Share						
U.S.		70.2%	67.4%	64.4%	64.9%	66.8%
Japan		28.1	27.3	27.3	24.1	26.8
Europe		1.8	5.3	8.3	11.0	6.4
Total		100.0%	100.0%	100.0%	100.0%	100.0%

(Continued)

MOS EPROM--Data

Table 2 (Continued)

16K MOS EPROM Shipment Data, 1976-1987

Company	MOS Process	1983				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	700	700	1,000	1,200	3,600
Burrotechnique	C	200	200	200	200	800
Fairchild	N	0	0	0	0	0
Fujitsu	N	50	50	0	0	100
Hitachi	N	100	100	50	0	250
Intel	N	1,000	1,000	800	700	3,500
Matsushita	N	100	100	100	100	400
Mitsubishi	N	180	120	160	130	590
Mostek	N	200	150	150	50	550
Motorola	N	50	80	30	0	160
National Semi.	N	2,150	2,500	2,500	2,800	9,950
	C	350	500	500	700	2,050
NEC	N	2,000	2,500	2,700	1,500	8,700
Oki Electric	N	400	400	350	350	1,500
SGS-Ates	N	500	800	800	900	3,000
Synertek	N	0	0	0	0	0
Texas Instruments	N	2,000	2,500	3,000	3,000	10,500
Toshiba	N	200	100	100	100	500
	N	9,630	11,100	11,740	10,830	43,300
	C	550	700	700	900	2,850
Total		10,180	11,800	12,440	11,730	46,150
Percentage Change from Previous Quarter						
		0%	16%	5%	(6%)	
Cumulative Total						
		142,335	154,135	166,575	178,305	
ASPs:						
NMOS		\$3.00	\$3.15	\$3.25	\$3.35	\$3.19
CMOS		0	0	0	0	0
Overall		\$3.00	\$3.15	\$3.25	\$3.35	\$3.19
Revenue (\$M)						
		28.9	35.0	38.2	36.3	138.3
Market Share						
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Year
U.S.		63.4%	63.0%	64.1%	72.0%	65.7%
Japan		29.8	28.6	27.8	18.6	26.1
Europe		6.9	8.5	8.0	9.4	8.2
Total		100.0%	100.0%	100.0%	100.0%	100.0%

(Continued)

MOS EPROM--Data

Table 2 (Continued)

16K MOS EPROM Shipment Data, 1976-1987

Company	MOS Process	1984				
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Year
AMD	N	1,000	1,100	1,200	1,300	4,600
Fairchild	N	0	0	0	0	0
Fujitsu	N	0	0	0	0	0
Hitachi	N	0	0	0	0	0
Intel	N	300	150	100	50	600
Matsushita	N	50	50	25	0	125
Mitsubishi	N	130	130	130	100	490
Mostek	N	0	0	0	0	0
Motorola	N	0	0	0	0	0
National Semi.	N	2,800	2,700	2,400	2,000	9,900
	C	700	700	550	400	2,350
NEC	N	1,350	1,200	950	700	4,200
Oki Electric	N	250	250	200	200	900
SGS	N	1,050	600	300	800	2,750
Synertek	N	0	0	0	0	0
Texas Instruments	N	3,500	3,000	2,000	1,800	10,300
Thomson-Eurotechnique	C	200	250	250	250	950
Toshiba	N	0	0	0	0	0
	N	10,430	9,180	7,305	6,950	33,865
	C	900	950	800	650	3,300
Total		11,330	10,130	8,105	7,600	37,165

Percentage Change from
Previous Quarter

(30) (110) (200) (60)

Cumulative Total

189,635 199,765 207,870 215,470

ASPs:	NMOS	\$3.35	\$3.35	\$3.00	\$2.85	\$3.17
	CMOS	\$5.50	\$5.50	\$5.25	\$4.50	\$5.24
	Overall	\$3.52	\$3.55	\$3.22	\$2.99	\$3.36

Revenue (\$M)	39.9	36.0	26.1	22.7	124.7
---------------	------	------	------	------	-------

	1984				
	1st	2nd	3rd	4th	Year
	<u>Qtr.</u>	<u>Qtr.</u>	<u>Qtr.</u>	<u>Qtr.</u>	
Market Share					
U.S.	73.3%	75.5%	77.1%	73.0%	74.7%
Japan	15.7	16.1	16.1	13.2	15.4
Europe	<u>11.0</u>	<u>8.4</u>	<u>6.8</u>	<u>13.8</u>	<u>10.0</u>
Total	100.0%	100.0%	100.0%	100.0%	100.0%

(Continued)

MOS EPROM--Data

Table 2 (Continued)

16K MOS EPROM Shipment Data, 1976-1987

Company	MOS Process	1985				
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Year
AMD	N	1,550	1,850	1,350	1,050	5,800
Fairchild	N	0	0	0	0	0
Fujitsu	N	0	0	0	0	0
Hitachi	N	0	0	0	0	0
Intel	N	0	0	0	0	0
Matsushita	N	0	0	0	0	0
Mitsubishi	N	50	50	0	0	100
Mostek	N	0	0	0	0	0
Motorola	N	0	0	0	0	0
National Semi.	N	1,800	1,600	1,500	1,200	6,100
	C	400	350	400	500	1,650
NEC	N	400	250	800	270	1,720
Oki Electric	N	150	150	100	100	500
SGS	N	750	800	1,100	1,200	3,850
Synertek	N	0	0	0	0	0
Texas Instruments	N	1,500	1,500	1,600	1,600	6,200
Thomson-Eurotechnique	C	350	450	400	500	1,700
Toshiba	N	0	0	0	0	0
	N	6,200	6,200	6,450	5,420	24,270
	C	750	800	800	1,000	3,350
Total		6,950	7,000	7,250	6,420	27,620
Percentage Change from Previous Quarter						
		(9%)	1%	4%	(11%)	
Cumulative Total		222,420	229,420	236,670	243,090	
ASPs:	NMOS	\$2.60	\$2.40	\$2.25	\$2.25	\$2.38
	CMOS	\$4.00	\$3.50	\$3.25	\$3.25	\$3.48
Overall		\$2.75	\$2.53	\$2.36	\$2.41	\$2.51
Revenue (\$M)		19.1	17.7	17.1	15.4	69.4
Market Share						
		1985				
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Year
U.S.		75.5%	75.7%	66.9%	67.8%	71.5%
Japan		8.6	6.4	12.4	5.8	8.4
Europe		15.8	17.9	20.7	26.5	20.1
Total		100.0%	100.0%	100.0%	100.0%	100.0%

(Continued)

MOS EPROM--Data

Table 2 (Continued)

16K MOS EPROM Shipment Data, 1976–1987

Company	MOS Process	1986				
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Year
AMD	N	1,000	600	450	375	2,425
Intel	N	250	250	250	250	1,000
National Semi.	N	1,500	1,200	950	800	4,450
NBC	N	180	220	80	40	520
SGS	N	356	189	600	400	1,545
Texas Instruments	N	750	750	400	200	2,100
Thomson	N	1,000	600	600	425	2,625
	N	5,036	3,809	3,330	2,490	14,665
	C	0	0	0	0	0
Total		5,036	3,809	3,330	2,490	14,665
Percentage Change from Previous Quarter		(22%)	(24%)	(13%)	(25%)	
Cumulative Total		248,126	251,935	255,265	257,755	
ASPs:	NMOS	\$2.35	\$2.40	\$2.40	\$2.50	\$2.40
	CMOS	0	0	0	0	0
	Overall	\$2.35	\$2.40	\$2.40	\$2.50	\$2.40
Revenue (\$M)		11.8	9.1	8.0	6.2	35.2
		1986 ¹				
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Year
Market Share						
U.S.		69.5%	73.5%	61.6%	65.3%	68.0%
Japan		3.6	5.8	2.4	1.6	3.5
Europe		26.9	20.7	36.0	33.1	29.4
Total		100.0%	100.0%	100.0%	100.0%	100.0%

(Continued)

MOS EPROM--Data

Table 2 (Continued)

16K MOS EPROM Shipment Data, 1976-1987

Company	MOS Process	1987				
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Year
AMD	N	500	350	300	350	1,500
Cypress	C	150	200	200	350	900
Intel	N	200	200	200	200	800
National Semi.	C	150	227	204	195	784
NEC	N	40	40	50	30	160
SGS-Thomson	N	1,195	1,125	1,240	720	4,280
	C	15	70	30	75	190
Texas Instruments	N	200	200	150	150	700
	C	50	50	110	125	335
WaferScale	C	10	25	75	75	185
	N	2,135	1,915	1,940	1,450	7,440
	C	383	572	619	820	2,394
Total		2,518	2,487	2,559	2,270	9,834
Percentage Change from Previous Quarter		1%	(1%)	3%	(11%)	
Cumulative Total		260,273	262,760	265,319	267,589	
ASPs:						
NMOS		\$2.55	\$2.60	\$2.65	\$2.70	\$2.62
CMOS		\$4.60	\$2.90	\$3.10	\$3.30	\$3.36
Overall		\$2.86	\$2.67	\$2.76	\$2.92	\$2.80
Revenue (\$M)		7.2	6.6	7.1	6.6	27.5
		1987				
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Year
Market Share						
U.S.		50.4%	50.3%	48.4%	63.7%	52.9%
Japan		1.6	1.6	2.0	1.3	1.6
Europe		48.1	48.0	49.6	35.0	45.5
Total		100.0%	100.0%	100.0%	100.0%	100.0%

Note: Columns may not add to totals shown because of rounding.

Source: Dataquest
April 1980

MOS EPROM--Data

Table 3

32K MOS EPROM Shipment Data, 1978-1987

Company	MOS Process	1978				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	N/A	N/A	N/A	N/A	0
Eurotechnique	C	N/A	N/A	N/A	N/A	0
Fujitsu	N	N/A	N/A	N/A	N/A	0
	C	N/A	N/A	N/A	N/A	0
Hitachi	N	N/A	N/A	N/A	N/A	0
Intel	N	N/A	N/A	N/A	S	0
Mitsubishi	N	N/A	N/A	N/A	N/A	0
Motorola	N	N/A	N/A	N/A	N/A	0
National Semi.	C	N/A	N/A	N/A	N/A	0
NEC	N	N/A	N/A	N/A	N/A	0
Ricoh	C	N/A	N/A	N/A	N/A	0
Rockwell	N	N/A	N/A	N/A	N/A	0
	C	N/A	N/A	N/A	N/A	0
SGS-Ates	N	N/A	N/A	N/A	N/A	0
Texas Instruments	N	N/A	N/A	N/A	S	5
Toshiba	N	N/A	N/A	N/A	N/A	0
	N	0	0	0	S	5
	C	0	0	0	0	0
Total		0	0	0	S	5
Percentage Change from Previous Quarter						
		0	0	0	0	-
Cumulative Total						
		0	0	0	S	
ASPs:	NMOS	0	0	0	0	\$80.00
	CMOS	0	0	0	0	0
	Overall	0	0	0	0	\$80.00
Revenue (\$M)						
		0	0	0	0	0
1978						
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Year
Market Share						
U.S.		0	0	0	0	0
Japan		0	0	0	0	0
Europe		0	0	0	0	0
Total		0	0	0	0	0

S = Sampling
N/A = Not Available

S = Sampling
N/A = Not Available

(Continued)

MOS EPROM--Data

Table 3 (Continued)

32K MOS EPROM Shipment Data, 1978-1987

Company	MOS Process	1979				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	N/A	N/A	N/A	N/A	0
Eurotechnique	C	N/A	N/A	N/A	N/A	0
Fujitsu	N	N/A	N/A	N/A	S	0
	C	N/A	N/A	N/A	N/A	0
Hitachi	N	N/A	N/A	N/A	S	0
Intel	N	5	30	50	100	185
Mitsubishi	N	N/A	N/A	N/A	S	0
Motorola	N	N/A	N/A	N/A	S	0
National Semi.	C	N/A	N/A	N/A	N/A	0
NEC	N	N/A	N/A	N/A	N/A	0
Ricoh	C	N/A	N/A	N/A	N/A	0
Rockwell	N	N/A	N/A	N/A	N/A	0
	C	N/A	N/A	N/A	N/A	0
SGS-Ates	N	N/A	N/A	N/A	N/A	0
Texas Instruments	N	10	35	60	90	195
Toshiba	N	N/A	N/A	N/A	N/A	0
	N	15	65	110	190	380
	C	0	0	0	0	0
Total		15	65	110	190	380

Percentage Change from Previous Quarter

0 333% 69% 73%

Cumulative Total

20 85 195 385

ASPs:	NMOS	\$80.00	\$80.00	\$75.00	\$75.00	\$76.05
	CMOS	0	0	0	0	0
	Overall	\$80.00	\$80.00	\$75.00	\$75.00	\$76.05

Revenue (\$M) 1.2 5.2 8.3 14.3 28.9

	1979				Year
	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
Market Share					
U.S.	100.0%	100.0%	100.0%	100.0%	100.0%
Japan	0	0	0	0	0
Europe	0	0	0	0	0
Total	100.0%	100.0%	100.0%	100.0%	100.0%

S = Sampling
N/A = Not Available

(Continued)

MOS EPROM--Data

Table 3 (Continued)

32K MOS EPROM Shipment Data, 1978-1987

Company	MOS Process	1980				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	N/A	N/A	S	2	2
Eurotechnique	C	N/A	N/A	N/A	N/A	0
Fujitsu	N	S	S	15	100	115
	C	N/A	N/A	N/A	N/A	0
Hitachi	N	S	120	220	280	620
Intel	N	165	250	325	450	1,190
Mitsubishi	N	S	6	40	90	136
Motorola	N	S	30	60	50	145
National Semi.	C	S	10	15	15	40
NEC	N	N/A	N/A	S	15	20
Ricoh	C	N/A	N/A	N/A	N/A	0
Rockwell	N	N/A	N/A	N/A	N/A	0
	C	N/A	N/A	N/A	N/A	0
SGS-Ates	N	N/A	N/A	N/A	N/A	0
Texas Instruments	N	150	300	350	450	1,250
Toshiba	N	N/A	S	5	10	15
	N	320	706	1,020	1,447	3,493
	C	0	10	15	15	40
Total		320	716	1,035	1,462	3,533
Percentage Change from Previous Quarter						
		68%	124%	45%	41%	
Cumulative Total						
		705	1,421	2,456	3,918	
ASPs: NMOS						
		\$55.00	\$40.00	\$30.00	\$10.00	\$26.03
CMOS						
		0	0	0	0	0
Overall						
		\$55.00	\$40.00	\$30.00	\$10.00	\$26.03
Revenue (\$M)						
		17.6	28.2	30.6	14.5	90.9
Market Share						
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Year
U.S.		100.0%	82.4%	72.5%	66.1%	74.4%
Japan		0	17.6	27.5	33.9	25.6
Europe		0	0	0	0	0
Total		100.0%	100.0%	100.0%	100.0%	100.0%

S = Sampling
N/A = Not Available

(Continued)

MOS EPROM--Data

Table 3 (Continued)
32K MOS EPROM Shipment Data, 1978-1987

<u>Company</u>	<u>MOS Process</u>	<u>1981</u>				<u>Year</u>
		<u>1st Qtr.</u>	<u>2nd Qtr.</u>	<u>3rd Qtr.</u>	<u>4th Qtr.</u>	
AMD	N	10	100	120	310	540
Eurotechnique	C	N/A	N/A	S	5	5
Fujitsu	N	150	170	600	1,000	1,920
	C	N/A	N/A	N/A	N/A	0
Hitachi	N	500	600	900	1,050	3,050
Intel	N	600	700	1,050	1,600	3,950
Mitsubishi	N	190	270	270	660	1,390
Motorola	N	50	120	250	350	770
National Semi.	C	10	20	30	30	90
NEC	N	30	50	325	700	1,105
Ricoh	C	N/A	N/A	N/A	N/A	0
Rockwell	N	N/A	N/A	N/A	N/A	0
	C	N/A	N/A	N/A	N/A	0
SGS-Ates	N	N/A	N/A	N/A	N/A	0
Texas Instruments	N	560	700	900	1,000	3,160
Toshiba	N	10	25	100	180	315
	N	2,100	2,735	4,515	6,850	16,200
	C	10	20	30	35	95
Total		2,110	2,755	4,545	6,885	16,295
Percentage Change from Previous Quarter		44%	31%	65%	51%	
Cumulative Total		6,028	6,783	13,328	20,213	
ASPs:						
NMOS		\$9.00	\$8.00	\$7.00	\$5.80	\$6.92
CMOS		0	0	0	0	0
Overall		\$9.00	\$8.00	\$7.00	\$5.80	\$6.92
Revenue (\$M)		18.9	21.9	31.6	39.7	112.1
		<u>1981</u>				<u>Year</u>
		<u>1st Qtr.</u>	<u>2nd Qtr.</u>	<u>3rd Qtr.</u>	<u>4th Qtr.</u>	
Market Share						
U.S.		58.3%	59.5%	51.7%	47.8%	52.2%
Japan		41.7	40.5	48.3	52.1	47.7
Europe		0	0	0	0	0
Total		100.0%	100.0%	100.0%	100.0%	100.0%
S = Sampling N/A = Not Available						

(Continued)

MOS EPROM--Data

Table 3 (Continued)

32K MOS EPROM Shipment Data, 1978-1987

Company	MOS Process	1982				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	600	1,050	650	850	3,150
Eurotechnique	C	30	100	150	200	480
Fujitsu	N	600	700	1,000	1,200	3,500
	C	N/A	N/A	N/A	S	0
Hitachi	N	1,500	2,500	2,500	2,500	9,000
Intel	N	2,000	2,500	2,500	2,500	9,500
Mitsubishi	N	1,450	1,500	1,800	1,500	6,250
Motorola	N	325	100	100	0	525
National Semi.	C	75	100	220	250	645
NEC	N	1,300	1,600	2,200	2,300	7,400
Ricoh	C	N/A	N/A	N/A	N/A	0
Rockwell	N	N/A	N/A	N/A	N/A	0
	C	N/A	N/A	N/A	N/A	0
SGS-Ates	N	S	10	25	50	85
Texas Instruments	N	500	600	700	900	2,700
Toshiba	N	300	400	600	600	1,900
	N	8,575	10,960	12,075	12,400	44,010
	C	105	200	370	450	1,125
Total		8,680	11,160	12,445	12,850	45,135
Percentage Change from Previous Quarter						
		26%	29%	12%	3%	
Cumulative Total		28,893	40,053	52,494	65,348	
ASPs: NMOS		\$6.00	\$5.50	\$5.00	\$4.75	\$5.25
CMOS		0	0	0	0	0
Overall		\$6.00	\$5.50	\$5.00	\$4.75	\$5.25
Revenue (\$M)		51.5	60.3	60.4	58.9	231.0
Market Share						
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Year
U.S.		40.3%	39.0%	33.5%	35.0%	36.6%
Japan		59.3	60.0	65.1	63.0	62.1
Europe		0.3	1.0	1.4	1.9	1.3
Total		100.0%	100.0%	100.0%	100.0%	100.0%

S = Sampling
N/A = Not Available

(Continued)

MOS EPROM--Data

Table 3 (Continued)

32K MOS EPROM Shipment Data, 1978-1987

Company	MOS Process	1983				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	800	1,000	1,200	1,500	4,500
Eurotechnique	C	200	300	400	400	1,300
Fujitsu	N	1,200	1,500	1,500	1,500	5,700
	C	10	25	50	50	135
Hitachi	N	3,000	3,500	3,500	3,000	13,000
Intel	N	2,500	2,500	2,200	1,800	9,000
Mitsubishi	N	1,600	1,700	1,500	1,300	6,100
Motorola	N	0	0	0	0	0
National Semi.	C	350	450	600	800	2,200
NBC	N	2,400	2,500	1,700	1,700	8,300
Ricoh	C	N/A	N/A	N/A	S	0
Rockwell	N	N/A	N/A	N/A	N/A	0
	C	N/A	N/A	S	25	25
SGS-Atee	N	50	100	100	100	350
Texas Instruments	N	1,000	2,000	3,000	3,500	9,500
Toshiba	N	600	400	500	500	2,000
	N	13,150	15,200	15,200	14,900	58,450
	C	560	775	1,050	1,275	3,660
Total		13,710	15,975	16,250	16,175	62,110

Percentage Change from Previous Quarter

7% 17% 2% 0%

Cumulative Total

79,058 95,033 111,283 127,458

ASPs: NMOS
CMOS
Overall

\$4.50 \$4.00 \$3.75 \$3.75 \$3.98
0 0 0 0 0
\$4.50 \$4.00 \$3.75 \$3.75 \$3.98

Revenue (\$M)

59.2 60.8 57.0 55.9 232.9

	1983				Year
	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
Market Share					
U.S.	33.9%	37.2%	43.1%	47.1%	40.6%
Japan	64.3	60.3	53.8	49.8	56.7
Europe	1.8	2.5	3.1	3.1	2.7
Total	100.0%	100.0%	100.0%	100.0%	100.0%

S = Sampling
N/A = Not Available

(Continued)

MOS EPROM--Data

Table 3 (Continued)

32K MOS EPROM Shipment Data, 1978-1987

Company	MOS Process	1984				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	1,600	1,800	2,200	2,200	7,800
Fujitsu	N	1,600	1,800	1,500	1,200	6,100
	C	150	250	250	250	900
Hitachi	N	2,500	2,000	1,500	1,200	7,200
Intel	N	1,800	1,800	2,000	2,000	7,600
Mitsubishi	N	1,100	900	650	400	3,050
Motorola	N	0	0	0	0	0
National Semi.	C	900	1,000	1,100	850	3,850
NEC	N	1,400	1,550	1,000	750	4,700
Ricoh	C	S	S	50	100	150
Rockwell	N	N/A	N/A	S	S	0
	C	50	25	0	0	75
SGS	N	200	350	600	1,000	2,150
Texas Instruments	N	3,800	4,000	3,200	2,200	13,200
Thomson-Eurotechnique	C	350	300	300	250	1,200
Toshiba	N	300	150	50	25	525
	N	14,300	14,350	12,700	10,975	52,325
	C	1,450	1,575	1,700	1,450	6,175
Total		15,750	15,925	14,400	12,425	58,500

Percentage Change from
Previous Quarter

	(34)	14	(104)	(144)	
Cumulative Total	143,208	159,133	173,533	185,958	
ASPs: NMOS	\$3.60	\$3.50	\$3.25	\$3.10	\$3.38
CMOS	\$7.50	\$7.50	\$7.25	\$7.00	\$7.31
Overall	\$3.96	\$3.90	\$3.72	\$3.56	\$3.80
Revenue (\$M)	62.4	62.0	53.6	44.2	222.2

	1984				Year
	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
Market Share					
U.S.	51.7%	54.2%	59.0%	58.4%	55.6%
Japan	44.8	41.8	34.7	31.6	38.7
Europe	3.5	4.1	6.3	10.1	5.7
Total	100.0%	100.0%	100.0%	100.0%	100.0%

S = Sampling
N/A = Not Available

(Continued)

MOS EPROM--Data

Table 3 (Continued)

32K MOS EPROM Shipment Data, 1978-1987

Company	MOS Process	1985				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	2,200	2,450	1,750	1,300	7,700
Fujitsu	N	800	600	300	250	1,950
	C	250	250	250	150	900
Ritachi	N	900	700	400	400	2,400
Intel	N	1,800	1,500	1,500	1,500	6,300
Mitsubishi	N	650	1,000	450	300	2,400
Motorola	N	0	0	0	0	0
National Semi.	C	700	600	500	500	2,300
NEC	N	730	500	800	530	2,560
Ricoh	C	150	200	200	150	700
Rockwell	N	50	50	0	0	100
	C	0	0	0	0	0
SGS	N	800	700	850	1,000	3,350
Texas Instruments	N	1,800	1,600	1,500	1,200	6,100
Thomson-Eurotechnique	C	350	400	400	400	1,550
Toshiba	N	0	0	0	0	0
	N	9,730	9,100	7,550	6,400	32,860
	C	1,450	1,450	1,350	1,200	5,450
Total		11,180	10,550	8,900	7,680	38,310
Percentage Change from Previous Quarter						
		(10%)	(6%)	(16%)	(14%)	
Cumulative Total						
		197,138	207,688	216,588	224,268	
ASPs: NMOS						
		\$2.80	\$2.25	\$2.20	\$2.20	\$2.39
CMOS						
		\$5.50	\$4.50	\$3.50	\$2.80	\$4.14
Overall						
		\$3.15	\$2.56	\$2.40	\$2.29	\$2.64
Revenue (\$M)						
		35.2	27.0	21.3	17.6	101.2
Market Share						
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Year
U.S.		58.6%	58.8%	59.0%	58.6%	58.7%
Japan		31.1	30.8	27.0	23.2	28.5
Europe		10.3	10.4	14.0	18.2	12.8
Total		100.0%	100.0%	100.0%	100.0%	100.0%

(Continued)

MOS EPROM—Data

Table 3 (Continued)

32K MOS EPROM Shipment Data, 1978-1987

		1986				
Company	MOS Process	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Year
AMD	N	950	850	675	450	2,925
Fujitsu	N	150	50	0	0	200
	C	50	0	0	0	50
Hitachi	N	500	200	100	50	850
Intel	N	1,300	1,300	1,000	1,550	5,150
	OTP	250	250	250	100	850
Mitsubishi	N	0	0	282	7	289
National Semi.	C	400	300	300	300	1,300
NEC	N	330	270	150	100	850
Ricoh	C	50	50	0	0	100
SGS	N	463	350	1,200	1,200	3,213
Texas Instruments	N	1,000	1,000	1,100	1,500	4,600
Thomson-Eurotechnique	C	300	300	300	300	1,200
	N	4,943	4,270	4,757	4,957	18,927
	C	800	650	600	600	2,650
Total		5,743	4,920	5,357	5,557	21,577
Percentage Change from Previous Quarter		(25%)	(14%)	9%	4%	
Cumulative Total		230,011	234,931	240,288	245,845	
ASPs:	NMOS	\$2.10	\$2.15	\$2.20	\$2.25	\$2.18
	CMOS	\$2.50	\$2.75	\$2.80	\$2.85	\$2.71
Overall		\$2.16	\$2.23	\$2.27	\$2.31	\$2.24
Revenue (\$M)		12.4	11.0	12.1	12.9	48.4
		1986				
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Year
Market Share						
U.S.		67.9%	75.2%	62.1%	70.2%	68.7%
Japan		18.8	11.6	9.9	2.8	10.8
Europe		13.3	13.2	28.0	27.0	20.5
Total		100.0%	100.0%	100.0%	100.0%	100.0%

(Continued)

MOS EPROM--Data

Table 3 (Continued)

32K MOS EPROM Shipment Data, 1978-1987

Company	MOS Process	1987				
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Year
AMD	N	425	500	475	575	1,975
Fujitsu	N	0	0	0	0	0
	C	0	0	0	0	0
Hitachi	N	0	0	0	0	0
	H	1,050	1,300	1,100	1,100	4,550
Intel	OTP	0	0	0	0	0
	N	0	0	0	0	0
Mitsubishi	N	0	0	0	0	0
National Semi.	C	750	750	744	628	2,872
NEC	N	100	20	20	10	150
Ricoh	C	0	0	0	0	0
	N	685	559	471	560	2,275
SGS-Thomson	C	75	65	50	45	235
	N	1,500	1,000	1,000	800	4,300
Texas Instruments	N	3,760	3,379	3,066	3,045	13,250
	C	825	815	794	673	3,107
Total		4,585	4,194	3,860	3,710	16,357
Percentage Change from Previous Quarter						
		(17%)	(9%)	(8%)	(4%)	
Cumulative Total		250,430	254,624	258,484	262,202	
ASPs:	NMOS	\$2.50	\$2.75	\$2.90	\$3.00	\$2.77
	CMOS	\$2.90	\$3.00	\$3.20	\$3.25	\$3.08
	Overall	\$2.57	\$2.80	\$2.96	\$3.05	\$2.83
Revenue (\$M)		11.8	11.7	11.4	11.3	46.3
Market Share						
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Year
U.S.		81.2%	84.6%	86.0%	83.5%	83.7%
Japan		2.2	0.5	0.5	0.3	0.9
Europe		16.6	14.9	13.5	16.3	15.3
Total		100.0%	100.0%	100.0%	100.0%	100.0%

Note: Columns may not add to totals shown because of rounding.

Source: Dataquest
April 1988

MOS EPROM--Data

Table 4

64K MOS EPROM Shipment Data, 1980-1987

Company	MOS Process	1980				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	N/A	N/A	N/A	N/A	0
Fujitsu	N	N/A	N/A	N/A	N/A	0
	C	N/A	N/A	N/A	N/A	0
Hitachi	N	N/A	N/A	N/A	S	0
	C	N/A	N/A	N/A	N/A	0
Intel	N	N/A	N/A	N/A	S	0
	N	N/A	N/A	N/A	N/A	0
Mitsubishi	N	N/A	N/A	N/A	N/A	0
Mostek	N	N/A	N/A	N/A	S	0
Motorola	N	S	S	S	S	10
NEC	N	N/A	N/A	N/A	N/A	0
	C	N/A	N/A	N/A	N/A	0
Oki Electric	N	N/A	N/A	N/A	N/A	0
Ricoh	C	N/A	N/A	N/A	N/A	0
Rockwell	N	N/A	N/A	N/A	N/A	0
	C	N/A	N/A	N/A	N/A	0
Seeq	N	N/A	N/A	N/A	N/A	0
Seiko-Epson	C	N/A	N/A	N/A	N/A	0
SGS-Ates	N	N/A	N/A	N/A	N/A	0
Sharp	C	N/A	N/A	N/A	N/A	0
Signetics	C	N/A	N/A	N/A	N/A	0
Texas Instruments	N	N/A	S	10	20	30
Toshiba	N	N/A	N/A	N/A	N/A	0
VLSI Technology	C	N/A	N/A	N/A	N/A	0
WaferScale Integ.	N	N/A	N/A	N/A	N/A	0
	N	0	0	15	25	40
	C	0	0	0	0	0
Total		0	0	15	25	40
Percentage Change from Previous Quarter						
		0	0	0	67%	
Cumulative Total						
		0	0	15	40	
ASPs: NMOS						
		0	0	0	0	0
CMOS						
		0	0	0	0	0
Overall						
		\$200.00	\$100.00	\$80.00	\$70.00	\$73.75
Revenue (\$M)						
		0	0	1.2	1.8	3.0
Market Share						
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Year
U.S.		0	0	100.0%	100.0%	100.0%
Japan		0	0	0	0	0
Europe		0	0	0	0	0
Total		0	0	100.0%	100.0%	100.0%

S = Sampling
N/A = Not Available

(Continued)

MOS EPROM--Data

Table 4 (Continued)

64K MOS EPROM Shipment Data, 1980-1987

Company	MOS Process	1981				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	N/A	N/A	N/A	N/A	0
Fujitsu	N	S	1	15	100	116
	C	N/A	N/A	N/A	N/A	0
Hitachi	N	S	2	5	25	32
	C	N/A	N/A	N/A	N/A	0
Intel	N	10	70	200	500	780
	N	N/A	N/A	N/A	N/A	0
Mitsubishi	N	N/A	N/A	N/A	S	0
Mostek	N	S	2	5	3	10
Motorola	N	15	40	30	50	135
NBC	N	N/A	N/A	N/A	S	0
	C	N/A	N/A	N/A	N/A	0
OKi Electric	N	N/A	N/A	N/A	N/A	0
Ricoh	C	N/A	N/A	N/A	N/A	0
Rockwell	N	N/A	N/A	N/A	N/A	0
	C	N/A	N/A	N/A	N/A	0
Seeq	N	N/A	N/A	N/A	N/A	0
Selko-Epson	C	N/A	N/A	N/A	N/A	0
SGS-Ates	N	N/A	N/A	N/A	N/A	0
Sharp	C	N/A	N/A	N/A	N/A	0
Signetics	C	N/A	N/A	N/A	N/A	0
Texas Instruments	N	30	65	100	100	295
Toshiba	N	N/A	N/A	N/A	N/A	0
VLSI Technology	C	N/A	N/A	N/A	N/A	0
WaferScale Integ.	N	N/A	N/A	N/A	N/A	0
	N	55	180	355	778	1,368
	C	0	0	0	0	0
Total		55	180	355	778	1,368
Percentage Change from Previous Quarter						
		120%	227%	97%	119%	
Cumulative Total						
		95	275	630	1,408	
ASPs: NMOS						
		0	0	0	0	0
CMOS						
		0	0	0	0	0
Overall						
		\$70.00	\$60.00	\$38.00	\$24.00	\$34.22
Revenue (\$M)						
		3.9	10.8	13.5	18.7	46.8
Market Share						
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Year
U.S.		100.0%	98.3%	94.4%	93.9%	89.2%
Japan		0	1.7	5.6	16.1	10.8
Europe		0	0	0	0	0
Total		100.0%	100.0%	100.0%	100.0%	100.0%

S = Sampling
N/A = Not Available

(Continued)

MOS EPROM--Data

Table 4 (Continued)

64K MOS EPROM Shipment Data, 1980-1987

Company	MOS Process	1982				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	S	10	250	500	760
Fujitsu	N	400	1,000	1,500	2,000	4,900
	C	10	25	50	100	185
Hitachi	N	100	250	600	800	1,750
	C	N/A	N/A	N/A	N/A	0
Intel	N	800	1,700	2,500	2,500	7,500
	N	N/A	N/A	N/A	N/A	0
Mitsubishi	N	S	15	500	1,400	1,915
Mostek	N	0	0	0	0	0
Motorola	N	60	100	100	100	360
NDC	N	S	10	60	200	270
	C	N/A	N/A	N/A	N/A	0
Ok! Electric	N	N/A	N/A	N/A	S	0
Ricoh	C	N/A	N/A	N/A	N/A	0
Rockwell	N	N/A	N/A	N/A	N/A	0
	C	N/A	N/A	N/A	N/A	0
Seeq	N	N/A	S	5	15	20
Seiko-Epson	C	N/A	N/A	N/A	N/A	0
SGS-Ates	N	N/A	N/A	N/A	N/A	0
Sharp	C	N/A	N/A	N/A	N/A	0
Signetics	C	N/A	N/A	N/A	N/A	0
Texas Instruments	N	100	100	100	100	400
Toshiba	N	N/A	S	20	50	70
VLSI Technology	C	N/A	N/A	N/A	N/A	0
WaferScale Integ.	N	N/A	N/A	N/A	N/A	0
	N	1,460	3,185	5,635	7,665	17,945
	C	10	25	50	100	185
Total		1,470	3,210	5,685	7,765	18,130
Percentage Change from Previous Quarter						
		69%	116%	77%	37%	
Cumulative Total						
		2,878	6,088	11,773	19,538	
ASPs: NMOS						
		0	0	0	0	0
CMOS						
		0	0	0	0	0
Overall						
		\$15.00	\$11.50	\$8.50	\$6.50	\$8.70
Revenue (\$M)						
		22.1	36.9	48.3	50.5	157.8
Market Share						
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Year
U.S.		65.3%	59.5%	52.0%	41.4%	49.9%
Japan		34.7	40.5	48.0	58.6	50.1
Europe		0	0	0	0	0
Total		100.0%	100.0%	100.0%	100.0%	100.0%

S = Sampling
N/A = Not Available

(Continued)

MOS EPROM--Data

Table 4 (Continued)

64K MOS EPROM Shipment Data, 1980-1987

Company	MOS Process	1983				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	600	900	1,300	1,800	4,600
Fujitsu	N	2,200	2,400	2,500	3,000	10,100
	C	250	300	350	400	1,300
Hitachi	N	1,500	2,300	3,500	5,500	12,800
	C	N/A	S	50	50	100
Intel	N	3,000	3,500	4,000	3,500	14,000
	N	N/A	N/A	N/A	N/A	0
Mitsubishi	N	1,700	2,000	3,200	3,800	10,700
Mostek	N	0	0	0	0	0
Motorola	N	150	200	450	700	1,500
NEC	N	350	500	500	600	1,950
	C	N/A	N/A	N/A	N/A	0
Oki Electric	N	25	50	100	200	375
Ricoh	C	N/A	N/A	N/A	N/A	0
Rockwell	N	N/A	N/A	N/A	N/A	0
	C	N/A	N/A	N/A	N/A	0
Seeq	N	25	100	310	600	1,035
Seiko-Epson	C	N/A	N/A	N/A	N/A	0
SGS-Ates	N	N/A	N/A	N/A	S	0
Sharp	C	N/A	N/A	N/A	N/A	0
Signetics	C	N/A	N/A	S	S	0
Texas Instruments	N	400	800	1,500	2,000	4,700
Toshiba	N	200	400	400	600	1,600
VLSI Technology	C	N/A	N/A	N/A	N/A	0
WaferScale Integ.	N	N/A	N/A	N/A	N/A	0
	N	10,150	13,150	17,760	22,300	63,360
	C	250	300	400	450	1,400
Total		10,400	13,450	18,160	22,750	64,760
Percentage Change from Previous Quarter						
		34%	29%	35%	25%	
Cumulative Total		29,938	43,388	61,548	84,298	
ASPs:	NMOS	0	0	0	0	0
	CMOS	0	0	0	0	0
Overall		\$5.50	\$4.75	\$5.00	\$5.50	\$5.20
Revenue (\$M)		57.2	63.9	90.8	125.1	337.0
Market Share						
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Year
U.S.		40.1%	40.9%	41.6%	37.8%	39.9%
Japan		59.9	59.1	58.4	62.2	60.1
Europe		0	0	0	0	0
Total		100.0%	100.0%	100.0%	100.0%	100.0%

S = Sampling
N/A = Not Available

(Continued)

MOS EPROM--Data

Table 4 (Continued)

64K MOS EPROM Shipment Data, 1980-1987

Company	MOS Process	1984				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	1,200	1,300	1,600	1,700	5,800
Fujitsu	N	2,500	2,800	3,000	3,000	11,300
	C	500	600	700	900	2,700
Hitachi	N	4,000	5,000	6,000	6,000	21,000
	C	100	250	300	350	1,000
Intel	N	2,000	2,000	2,000	2,000	8,000
	N	N/A	N/A	N/A	S	0
Mitsubishi	N	5,000	5,700	5,700	5,000	21,400
Mostek	N	0	0	0	0	0
Motorola	N	900	900	600	500	2,900
NEC	N	800	1,400	900	1,200	4,300
	C	N/A	N/A	N/A	S	0
Oki Electric	N	400	600	500	400	1,900
Ricoh	C	N/A	0	25	100	125
Rockwell	N	S	10	0	0	10
	C	10	50	0	0	60
Seeq	N	800	1,000	1,050	1,100	3,950
Seiko-Epson	C	N/A	N/A	N/A	N/A	0
SGS	N	50	150	350	600	1,150
Sharp	C	N/A	N/A	N/A	N/A	0
Signetics	C	S	10	10	10	30
Texas Instruments	N	2,400	2,600	2,800	2,400	10,200
Toshiba	N	400	1,200	800	500	2,900
VLSI Technology	C	N/A	N/A	N/A	N/A	0
WaferScale Integ.	N	N/A	N/A	N/A	N/A	0
	N	20,450	24,660	25,300	24,400	94,810
	C	610	910	1,035	1,360	3,915
Total		21,060	25,570	26,335	25,760	98,725
Percentage Change from Previous Quarter		(7%)	21%	3%	(2%)	
Cumulative Total		105,358	130,928	157,263	183,023	
ASPs: NMOS		\$5.25	\$5.25	\$4.75	\$4.25	\$4.86
CMOS		\$15.00	\$15.00	\$13.50	\$10.00	\$12.87
Overall		\$5.53	\$5.60	\$5.09	\$4.55	\$5.18
Revenue (\$M)		116.5	143.1	134.1	117.3	511.1
Market Share		1984				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
U.S.		34.7%	30.8%	30.6%	29.9%	31.3%
Japan		65.1	68.6	68.1	67.7	67.5
Europe		0.2	0.6	1.3	2.3	1.2
Total		100.0%	100.0%	100.0%	100.0%	100.0%

S = Sampling

N/A = Not Available

(Continued)

MOS EPROM--Data

Table 4 (Continued)

64K MOS EPROM Shipment Data, 1980-1987

Company	MOS Process	1985				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	2,100	1,550	1,825	1,150	6,625
Fujitsu	N	3,500	3,500	3,800	3,500	14,300
	C	800	950	1,000	1,200	3,950
Hitachi	N	5,500	5,200	5,000	4,500	20,200
	C	400	400	450	500	1,750
Intel	N	2,600	3,000	3,000	2,900	11,500
	N	25	75	150	250	500
Mitsubishi	N	4,850	2,600	4,300	4,200	15,950
Mostek	N	0	0	0	0	0
Motorola	N	400	300	300	400	1,400
NEC	N	1,250	1,450	1,650	1,800	6,150
	C	40	200	350	300	890
Oki Electric	N	350	300	200	150	1,000
Ricoh	C	200	250	250	150	850
Rockwell	N	0	0	0	0	0
	C	0	0	0	0	0
Seeq	N	625	500	350	275	1,750
Seiko-Epson	C	N/A	N/A	N/A	S	0
SGS	N	880	850	1,000	1,350	4,080
Sharp	C	N/A	N/A	N/A	S	0
Signetics	C	0	0	0	0	0
Texas Instruments	N	2,200	2,000	2,000	2,000	8,200
Tohiba	N	800	600	500	350	2,250
VLSI Technology	C	N/A	S	20	40	60
WaferScale Integ.	N	N/A	N/A	S	10	10
	N	25,000	21,925	24,075	22,825	93,905
	C	1,440	1,800	2,070	2,200	7,510
Total		26,520	23,725	26,145	25,025	101,415
Percentage Change from Previous Quarter		3%	(11%)	10%	(4%)	
Cumulative Total		209,543	233,268	259,413	284,438	
ASPs: NMOS		\$3.60	\$2.80	\$2.35	\$2.10	\$2.73
CMOS		\$6.00	\$4.55	\$3.75	\$3.25	\$4.23
Overall		\$3.63	\$2.93	\$2.46	\$2.20	\$2.84
Revenue (\$M)		98.9	69.6	64.3	55.1	287.9
Market Share						
U.S.		30.0%	31.3%	29.2%	28.1%	29.6%
Japan		66.7	65.1	66.9	66.5	66.4
Europe		3.3	3.6	3.8	5.4	4.0
Total		100.0%	100.0%	100.0%	100.0%	100.0%

S = Sampling
N/A = Not Available

(Continued)

MOS EPROM--Data

Table 4 (Continued)

64K MOS EPROM Shipment Data, 1980-1987

Company	MOS Process	1986				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	850	800	900	1,385	3,935
Fujitsu	N	1,500	1,500	2,000	4,000	9,000
	C	1,000	1,000	2,000	4,000	8,000
General Instruments	C	S	0	31	170	201
	OTP	N/A	N/A	S	10	10
Goldstar	C	S	S	0	5	5
Hitachi	N	5,400	5,000	4,500	4,000	18,900
	C	700	700	700	700	2,800
Hyundai	C	S	S	0	5	5
Intel	N	3,400	3,300	2,400	3,200	12,300
	C	250	500	425	400	1,575
	N OTP	400	400	300	200	1,300
	C OTP	0	30	130	100	260
Mitsubishi	N	3,226	3,339	3,459	2,810	12,834
	OTP	775	43	564	511	1,893
Motorola	N	147	346	177	114	784
	OTP	66	87	54	22	229
National Semi.	C	25	75	150	200	450
NEC	N	1,850	1,000	300	150	3,300
	C	800	1,000	490	300	2,590
	OTP	240	140	100	50	530
Ricoh	C	0	0	25	50	75
Seeq	N	525	615	315	150	1,605
Seiko-Epson	C	0	75	100	150	325
SGS	N	552	608	2,500	2,500	6,160
Sharp	C	0	5	10	15	30
	OTP	S	S	0	0	0
Signetix	C	0	5	5	10	20
Texas Instruments	N	1,400	1,400	1,600	1,600	6,000
Toshiba	N	500	600	600	900	2,600
	OTP	100	400	500	500	1,500
VLSI Technology	C	40	40	40	50	170
WaferScale Integ.	C	0	10	10	10	30
Others	C	0	0	5	5	10
	N	20,691	19,438	20,369	22,042	82,540
	C	3,055	3,580	4,221	6,230	17,086
Total		23,746	23,018	24,590	28,272	99,626
Percentage Change from Previous Quarter						
		(5%)	(3%)	7%	15%	
Cumulative Total						
		308,184	331,202	355,792	384,064	
ASPs:						
	NNOS	\$2.15	\$2.35	\$2.60	\$2.75	\$2.47
	CNOS	\$3.50	\$3.75	\$3.85	\$4.10	\$3.86
	Overall	\$2.32	\$2.57	\$2.81	\$3.05	\$2.71
Revenue (\$M)						
		55.2	59.1	69.2	86.2	269.7
Market Share						
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Year
U.S.		29.9%	33.1%	27.4%	27.0%	29.2%
Japan		67.8	64.3	62.4	64.1	64.6
Europe		2.3	2.6	10.2	8.8	6.2
ROM		0	0	0	0	0
Total		100.0%	100.0%	100.0%	100.0%	100.0%

S = Sampling
N/A = Not Available

(Continued)

MOS EPROM--Data

Table 4 (Continued)

64K MOS EPROM Shipment Data, 1980-1987

Company	MOS Process	1987				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	1,300	1,500	1,150	1,750	5,700
Cypress	C	50	75	100	100	325
Fujitsu	N	400	500	800	800	2,500
	C	1,800	2,000	2,200	2,200	8,200
Goldstar	C	5	5	5	5	20
Hitachi	N	2,500	1,500	1,000	0	5,000
	C	700	700	400	0	1,800
	C OTP	0	50	100	0	150
Hyundai	C	5	5	10	20	40
Intel	N	1,400	1,400	1,100	1,700	5,600
	C	400	400	500	400	1,700
	N OTP	350	300	150	250	1,050
	C OTP	200	250	200	200	850
Microchip Tech., Inc.	C	100	200	350	500	1,150
	OTP	10	20	50	100	180
Mitsubishi	N	1,450	1,150	1,250	1,700	5,550
	OTP	450	250	200	350	1,250
Motorola	N	125	100	86	60	371
	OTP	17	10	13	6	46
National Semi.	C	606	1,198	1,580	2,341	5,725
	C OTP	N/A	N/A	N/A	8	0
NEC	N	400	60	70	0	530
	C	1,000	370	390	200	1,960
	OTP	0	0	0	0	0
Oki Electric	N	50	50	50	50	200
	N OTP	450	450	400	350	1,650
Ricoh	C	50	50	100	100	300
Seeq	N	200	200	200	200	800
Seiko-Epson	C	100	100	100	100	400
SGS-Thomson	N	872	1,643	2,081	2,100	6,696
	C	80	110	40	100	330
	C OTP	5	45	70	100	220
Sharp	C	0	80	150	250	480
	OTP	0	0	0	0	0
Signetics	C	200	200	250	250	900
Texas Instruments	N	1,100	1,200	1,350	1,400	5,050
Toshiba	N	700	500	500	200	1,900
	N OTP	1,000	1,000	1,000	1,000	4,000
VLSI Technology	C	75	100	100	100	375
WaferScale Integ.	C	30	50	50	50	180
	N	12,764	11,813	11,400	11,916	47,893
	C	5,416	6,008	6,745	7,116	25,285
Total		18,180	17,821	18,145	19,032	73,178

(Continued)

MOS EPROM--Data

Table 4 (Continued)
64K MOS EPROM Shipment Data, 1980-1987

Percentage Change from Previous Quarter		(36%)	(2%)	2%	5%	
Cumulative Total		402,244	420,065	438,210	457,242	
ASPs:	NMOS	\$2.80	\$2.90	\$3.00	\$3.10	\$2.95
	CMOS	\$3.00	\$3.10	\$3.00	\$3.20	\$3.08
	Overall	\$2.86	\$2.97	\$3.00	\$3.14	\$2.99
Revenue (\$M)		52.0	52.9	54.4	59.7	219.0

1987					
	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Year
Market Share					
U.S.	33.9%	40.4%	39.8%	49.4%	41.0%
Japan	60.8	49.4	48.0	38.4	49.0
Europe	5.3	10.1	12.1	12.1	9.9
ROW	0.1	0.1	0.1	0.1	0.1
Total	100.0%	100.0%	100.0%	100.0%	100.0%

S = Sampling

N/A = Not Available

Note: Columns may not add to totals shown because of rounding.

Source: Dataquest
April 1988

MOS EPROM--Data

Table 5

128K MOS EPROM Shipment Data, 1982-1987

Company	MOS Process	1982				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	N/A	N/A	N/A	S	0
Fujitsu	N	N/A	N/A	N/A	S	0
	C	N/A	N/A	N/A	N/A	0
Hitachi	N	N/A	N/A	N/A	S	0
Intel	N	3	15	50	150	218
Mitsubishi	N	N/A	N/A	N/A	N/A	0
	C	N/A	N/A	N/A	N/A	0
NEC	N	N/A	N/A	N/A	N/A	0
Seeq	N	N/A	N/A	N/A	S	0
Texas Instruments	N	N/A	S	5	5	10
	C	N/A	N/A	N/A	N/A	0
Toshiba	N	N/A	N/A	N/A	N/A	N/A
	N	3	15	55	155	228
	C	0	0	0	0	0
Total		3	15	55	155	228
Percentage Change from Previous Quarter						
		0	400%	267%	182%	
Cumulative Total						
		3	18	73	228	
Average Selling Price						
		\$75.00	\$60.00	\$50.00	\$40.00	\$44.19
Revenue (\$M)						
		0.2	0.9	2.8	6.2	10.1
Market Share						
		100.0%	100.0%	100.0%	100.0%	100.0%
U.S.		0	0	0	0	0
Japan		0	0	0	0	0
Europe		0	0	0	0	0
Total		100.0%	100.0%	100.0%	100.0%	100.0%

S = Sampling
N/A = Not Available

(Continued)

MOS EPROM--Data

Table 5 (Continued)

128K MOS EPROM Shipment Data, 1982-1987

Company	MOS Process	1983				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	50	175	300	500	1,025
Fujitsu	N	10	50	150	350	560
	C	8	10	25	35	70
Hitachi	N	10	50	150	350	560
Intel	N	450	800	1,200	1,500	3,950
Mitsubishi	N	8	10	10	10	30
	C	N/A	N/A	N/A	N/A	0
NEC	N	8	10	20	100	130
Seeq	N	N/A	8	50	100	150
Texas Instruments	N	0	0	0	0	0
	C	N/A	N/A	N/A	N/A	0
Toshiba	N	8	10	20	50	80
	N	520	1,105	1,900	2,960	6,485
	C	0	10	25	35	70
Total		520	1,115	1,925	2,995	6,555
Percentage Change from Previous Quarter						
		235%	114%	73%	56%	
Cumulative Total						
		748	1,863	3,788	6,783	
Average Selling Price						
		\$30.00	\$22.00	\$17.00	\$16.00	\$18.44
Revenue (\$M)						
		15.6	24.5	32.7	47.9	120.8
Market Share						
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Year
U.S.		96.2%	87.4%	80.5%	70.1%	78.2%
Japan		3.8	12.6	19.5	29.9	21.8
Europe		0	0	0	0	0
Total		100.0%	100.0%	100.0%	100.0%	100.0%

S = Sampling
N/A = Not Available

(Continued)

MOS EPROM--Data

Table 5 (Continued)

128K MOS EPROM Shipment Data, 1982-1987

Company	MOS Process	1984				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	500	800	850	900	3,050
Fujitsu	N	550	750	800	700	2,800
	C	50	75	100	100	325
Hitachi	N	650	1,800	2,000	2,800	7,250
Intel	N	1,500	1,600	1,700	2,200	7,000
Mitsubishi	N	60	400	1,500	2,200	4,160
	C	N/A	N/A	N/A	S	0
NEC	N	20	160	600	1,000	1,780
Seeq	N	150	400	525	575	1,650
Texas Instruments	N	10	25	25	25	85
	C	N/A	N/A	N/A	N/A	0
Toshiba	N	100	300	500	900	1,800
	N	3,540	6,235	8,500	11,300	29,575
	C	50	75	100	100	325
Total		3,590	6,310	8,600	11,400	29,900
Percentage Change from Previous Quarter						
		20%	76%	36%	33%	
Cumulative Total		10,373	16,683	25,283	36,683	
ASPs: NMOS		\$15.25	\$14.00	\$12.25	\$10.00	\$12.12
CMOS		\$28.00	\$25.00	\$20.00	\$18.00	\$21.77
Overall		\$15.43	\$14.13	\$12.34	\$10.07	\$12.22
Revenue (\$M)		55.4	89.2	106.1	114.8	365.5
Market Share						
U.S.		60.2%	44.8%	36.0%	32.5%	39.4%
Japan		39.8	55.2	64.0	67.5	60.6
Europe		0	0	0	0	0
Total		100.0%	100.0%	100.0%	100.0%	100.0%

S = Sampling
N/A = Not Available

(Continued)

MOS EPROM--Data

Table 5 (Continued)

128K MOS EPROM Shipment Data, 1982-1987

Company	MOS Process	1985				
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Year
AMD	N	1,150	950	850	900	3,850
Fujitsu	N	1,000	1,500	1,750	2,000	6,250
	C	100	100	100	100	400
Hitachi	N	3,000	3,200	3,500	3,100	12,800
Intel	N	2,000	1,800	2,000	2,200	8,000
Mitsubishi	N	1,800	2,000	2,700	3,000	9,500
	C	5	10	10	100	125
NEC	N	1,500	2,000	1,750	3,200	8,450
Seeq	N	375	300	250	225	1,150
Texas Instruments	N	50	25	0	0	75
	C	N/A	N/A	5	25	25
Toshiba	N	1,000	1,200	1,500	1,500	5,200
	N	11,875	12,975	14,300	16,125	55,275
	C	105	110	110	225	550
Total		11,980	13,085	14,410	16,350	55,825
Percentage Change from Previous Quarter		5%	9%	10%	13%	
Cumulative Total		48,663	61,748	76,138	92,508	
ASPs:	NMOS	\$6.50	\$4.10	\$3.10	\$2.60	\$3.92
	CMOS	\$15.00	\$9.00	\$5.00	\$3.75	\$7.20
	Overall	\$6.57	\$4.14	\$3.11	\$2.62	\$3.95
Revenue (\$M)		78.8	54.2	44.9	42.8	220.6
		1985				
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Year
Market Share						
U.S.		29.8%	23.5%	21.5%	20.5%	23.5%
Japan		70.2	76.5	78.5	79.5	76.5
Europe		0	0	0	0	0
Total		100.0%	100.0%	100.0%	100.0%	100.0%

S = Sampling
N/A = Not Available

(Continued)

MOS EPROM--Data

Table 5 (Continued)

128K MOS EPROM Shipment Data, 1982-1987

Company	MOS Process	1986				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	1,300	1,100	1,050	1,715	5,165
Fujitsu	N	800	800	800	800	3,200
	C	100	100	100	100	400
General Instrument	C	N/A	S	20	150	170
	OTP	N/A	N/A	S	10	10
Hitachi	N	3,200	3,000	2,500	2,500	11,200
Intel	N	2,200	2,600	2,800	2,900	10,500
	OTP	200	500	650	400	1,750
Mitsubishi	N	2,300	1,850	1,800	1,700	7,650
	C	75	70	90	120	355
	N OTP	650	650	550	300	2,150
	C OTP	0	0	0	0	0
NEC	N	3,110	3,000	1,520	1,000	8,630
Seeg	N	325	325	300	225	1,175
Seiko-Epson	N	0	10	15	25	50
Texas Instruments	N	N/A	N/A	N/A	N/A	0
	C	100	175	225	400	900
Toshiba	N	700	700	700	600	2,700
	OTP	50	200	400	600	1,250
VLSI Technology	C	5	10	10	10	35
WaferScale Inteq.	C	S	0	5	5	10
Others	C	N/A	S	S	10	15
	N	14,835	14,735	13,085	12,780	55,435
	C	280	355	455	805	1,895
Total		15,115	15,090	13,540	13,585	57,330
Percentage Change from Previous Quarter						
		(8%)	0	(10%)	0	
Cumulative Total						
		107,623	122,713	136,253	149,123	
ASPs:						
	NMOS	\$2.55	\$2.65	\$2.75	\$2.75	\$ 2.67
	CMOS	\$3.70	\$3.90	\$4.00	\$4.00	\$ 3.94
	Overall	\$2.57	\$2.68	\$2.79	\$2.82	\$ 2.71
Revenue (\$M)						
		38.9	40.4	37.8	38.4	155.5
Market Share						
	U.S.	27.3%	31.2%	37.4%	42.9%	34.4%
	Japan	72.7	68.8	62.6	57.0	65.6
	Europe	0.0	0.0	0.0	0.1	0.0
Total		100.0%	100.0%	100.0%	100.0%	100.0%

S = Sampling
N/A = Not Applicable

(Continued)

MOS EPROM--Data

Table 5 (Continued)

128K MOS EPROM Shipment Data, 1982-1987

Company	MOS Process	1987				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	1,300	1,925	1,725	1,875	6,825
Fujitsu	N	1,000	1,200	1,100	1,100	4,400
	C	600	800	900	900	3,200
Hitachi	N	2,000	2,000	1,800	0	5,800
Intel	N	2,200	2,250	1,000	2,250	7,700
	N OTP	800	600	420	140	1,960
	C	0	100	250	300	650
	C OTP	0	0	20	20	40
Microchip Tech., Inc.	C	200	250	420	400	1,270
	C OTP	20	45	80	200	345
Mitsubishi	N	1,150	1,300	1,400	950	4,800
	C	40	100	130	60	330
	N OTP	120	250	300	100	770
	C OTP	0	0	0	0	0
National Semi.	C	222	191	223	390	1,026
NEC	N	900	590	430	330	2,250
Oni Electric	N	100	150	100	100	450
	N OTP	400	450	400	350	1,600
Seeq	N	150	150	100	100	500
Seiko-Epson	N	0	10	15	25	50
SGS-Thomson	N	178	525	1,157	1,700	3,560
Texas Instruments	N	0	25	25	70	120
	C	800	900	1,000	1,200	3,900
Toshiba	N	500	500	600	600	2,200
	N OTP	900	1,000	1,000	1,000	3,900
VLSI Technology	C	5	10	10	10	35
WaferScale Integ.	C	5	0	5	5	10
	N	11,698	12,915	11,572	10,690	46,885
	C	1,887	2,396	3,038	3,485	10,806
Total		13,585	15,321	14,610	14,175	57,691
Percentage Change from Previous Quarter						
		6%	13%	(5%)	(3%)	
Cumulative Total						
		162,708	178,029	192,639	206,814	
ASPs: NMOS						
		\$3.00	\$3.35	\$3.45	\$3.75	\$ 3.38
CMOS						
		\$3.90	\$3.80	\$3.90	\$4.25	\$ 3.99
Overall						
		\$3.13	\$3.42	\$3.54	\$3.87	\$ 3.49
Revenue (\$M)						
		42.5	52.4	51.8	54.9	201.5
Market Share						
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Year
U.S.		41.9%	42.1%	36.1%	49.1%	42.3%
Japan		56.8	54.5	56.0	38.9	51.6
Europe		1.3	3.4	7.9	12.0	6.2
Total		100.0%	100.0%	100.0%	100.0%	100.0%

S = Sampling

N/A = Not Applicable

Note: Columns may not add to totals shown because of rounding.

Source: Dataquest
April 1988

MOS EPROM--Data

Table 6

256K MOS EPROM Shipment Data, 1983-1987

<u>Company</u>	<u>MOS Process</u>	<u>1983</u>				<u>Year</u>
		<u>1st Qtr.</u>	<u>2nd Qtr.</u>	<u>3rd Qtr.</u>	<u>4th Qtr.</u>	
AMD	N	N/A	S	10	25	35
Atmel	N	N/A	N/A	N/A	N/A	0
	C	N/A	N/A	N/A	N/A	0
Fujitsu	N	N/A	N/A	N/A	N/A	0
	C	S	S	5	20	25
General Instrument	N	N/A	N/A	N/A	N/A	0
	C	N/A	N/A	N/A	N/A	0
Hitachi	N	N/A	N/A	N/A	N/A	0
	C	N/A	N/A	N/A	N/A	0
Intel	N	5	10	35	90	140
	C	N/A	N/A	N/A	N/A	0
Mitsubishi	N	N/A	N/A	N/A	S	0
National Semi.	C	N/A	N/A	N/A	N/A	0
NBC	N	N/A	N/A	N/A	S	0
	C	N/A	N/A	N/A	N/A	0
Seeq	C	N/A	N/A	N/A	N/A	0
Seiko-Epson	C	N/A	N/A	N/A	N/A	0
SGS-Ates	N	N/A	N/A	N/A	N/A	0
Texas Instruments	C	N/A	N/A	N/A	N/A	0
Toshiba	N	N/A	N/A	N/A	N/A	0
	C	N/A	N/A	N/A	N/A	0
VLSI Technology	C	N/A	N/A	N/A	N/A	0
WaferScale Integ.	C	N/A	N/A	N/A	N/A	0
	N	5	10	45	115	175
	C	0	0	5	20	25
Total		5	10	50	135	200
Percentage Change from Previous Quarter		0	100%	400%	170%	
Cumulative Total		5	15	65	200	
ASPs: NMOS		\$150	\$125	\$100	\$95	\$100
CMOS		0	0	\$145	\$115	\$121
Overall		\$150	\$125	\$105	\$98	\$102
Revenue (\$M)		0.8	1.3	5.2	13.2	20.5
		<u>1983</u>				<u>Year</u>
		<u>1st Qtr.</u>	<u>2nd Qtr.</u>	<u>3rd Qtr.</u>	<u>4th Qtr.</u>	
Market Share						
U.S.		100.0%	100.0%	100.0%	100.0%	100.0%
Japan		0	0	0	0	0
Europe		0	0	0	0	0
Total		100.0%	100.0%	100.0%	100.0%	100.0%

S = Sampling
N/A = Not Available

(Continued)

MOS EPROM--Data

Table 6 (Continued)

256K MOS EPROM Shipment Data, 1983-1987

Company	MOS Process	1984				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	100	130	100	250	580
Atmel	N	N/A	N/A	N/A	N/A	0
	C	N/A	N/A	N/A	N/A	0
Fujitsu	N	N/A	N/A	N/A	10	10
	C	30	40	50	75	195
General Instrument	N	N/A	N/A	N/A	N/A	0
	C	N/A	N/A	N/A	N/A	0
Hitachi	N	N/A	N/A	S	S	0
	C	N/A	N/A	S	S	0
Intel	N	150	250	375	475	1,250
	C	N/A	N/A	N/A	N/A	0
Mitsubishi	N	S	S	S	S	5
National Semi.	C	N/A	N/A	N/A	N/A	0
NBC	N	S	S	S	S	5
	C	N/A	N/A	N/A	N/A	0
Seeq	C	N/A	S	S	S	5
Seiko-Epson	C	N/A	N/A	N/A	N/A	0
SGS	N	N/A	N/A	N/A	N/A	0
Texas Instruments	C	N/A	N/A	N/A	N/A	0
Toshiba	N	10	30	50	100	190
	C	N/A	N/A	S	S	0
VLSI Technology	C	N/A	N/A	N/A	N/A	0
WaferScale Integ.	C	N/A	—	—	—	0
	N	260	410	525	845	2,040
	C	30	40	50	60	200
Total		290	450	575	925	2,240
Percentage Change from Previous Quarter						
		115%	55%	28%	61%	
Cumulative Total						
		490	940	1,515	2,440	
ASPs: NMOS						
		\$75.00	\$45.00	\$35.00	\$28.00	\$39.21
CMOS						
		\$100.00	\$80.00	\$60.00	\$45.00	\$64.00
Overall						
		\$77.59	\$48.11	\$37.17	\$29.47	\$41.42
Revenue (\$M)						
		22.5	21.7	21.4	27.3	92.8
Market Share						
U.S.		86.2%	84.4%	82.6%	78.9%	81.9%
Japan		13.8	15.6	17.4	21.1	18.1
Europe		0	0	0	0	0
Total		100.0%	100.0%	100.0%	100.0%	100.0%

S = Sampling
N/A = Not Available

(Continued)

MOS EPROM--Data

Table 6 (Continued)

256K MOS EPROM Shipment Data, 1983-1987

Company	MOS Process	1985				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	450	800	950	950	3,150
Atmel	N	N/A	N/A	N/A	S	0
	C	N/A	N/A	N/A	S	0
Fujitsu	N	25	200	400	650	1,275
	C	150	250	400	600	1,400
General Instrument	N	N/A	N/A	S	25	25
	C	N/A	N/A	S	10	10
Hitachi	N	50	200	500	800	1,550
	C	S	25	150	300	475
Intel	N	1,000	1,800	2,400	2,700	7,900
	C	N/A	S	50	100	150
Mitsubishi	N	S	25	70	600	700
National Semi.	C	S	S	S	10	10
	N	30	230	550	750	1,560
NEC	C	S	50	150	200	400
	C	15	110	180	250	555
Seeq	C	N/A	N/A	N/A	S	0
Seiko-Epson	N	N/A	N/A	N/A	S	10
SGS	C	N/A	N/A	S	50	50
Texas Instruments	N	150	350	550	700	1,750
Toshiba	C	150	200	300	425	1,075
	C	N/A	S	25	50	75
VLSI Technology	C	N/A	N/A	S	S	0
WaferScale Integ.	N	1,710	3,605	5,420	7,185	17,920
	C	315	635	1,255	1,995	4,200
Total		2,025	4,240	6,675	9,180	22,120
Percentage Change from Previous Quarter		350%	109%	57%	38%	
Cumulative Total		4,465	8,705	15,380	24,560	
ASPs:	NMOS	\$20.00	\$12.00	\$5.30	\$4.25	\$7.63
	CMOS	\$30.00	\$13.50	\$7.00	\$6.00	\$9.23
	Overall	\$21.56	\$12.22	\$5.62	\$4.63	\$7.93
Revenue (\$M)		43.7	51.8	37.5	42.5	175.5
				1985		
Market Share		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Year
U.S.		72.3%	63.9%	54.0%	45.2%	53.9%
	Japan	27.7	36.1	46.0	54.7	46.0
	Europe	0	0	0	0.1	0
Total		100.0%	100.0%	100.0%	100.0%	100.0%

S = Sampling
N/A = Not Available

(Continued)

MOS EPROM--Data

Table 6 (Continued)

256K MOS EPROM Shipment Data, 1983-1987

Company	MOS Process	1986				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	700	1,000	1,050	1,000	3,750
Atmel	N	0	0	0	0	0
	C	0	0	0	0	0
Fujitsu	N	500	500	500	600	2,100
	C	200	250	250	400	1,100
General Instrument	N	908	600	545	500	2,553
	C	112	317	493	500	1,422
	C OTP	35	85	10	200	330
Hitachi	N	950	1,100	1,350	1,500	4,900
	C	350	500	650	800	2,300
	C OTP	0	0	0	0	0
Intel	N	3,300	4,000	4,200	4,000	15,500
	C	150	175	450	550	1,325
	N OTP	200	250	280	300	1,030
Mitsubishi	N	1,637	2,096	1,776	935	6,444
	C	0	0	19	157	176
	N OTP	1,249	1,480	1,435	3,435	7,599
	C OTP	0	0	0	0	0
National Semi.	C	25	100	250	300	675
NEC	N	1,230	1,250	990	500	3,970
	C	1,620	1,220	1,140	800	4,780
Oki Electric	N	N/A	S	0	30	30
Ricoh	C	0	0	5	5	10
Seeq	C	70	70	40	40	220
Seiko-Epson	C	0	5	10	10	25
SGS	N	6	136	10	10	162
Signetics	C	S	S	5	15	20
Texas Instrument	C	125	200	225	800	1,350
Toshiba	N	600	800	800	800	3,000
	C	300	400	400	400	1,500
	N OTP	300	500	800	1,200	2,800
	C OTP	100	200	200	200	700
VLSI Technology	C	50	50	50	50	200
WaferScale Integ.	C	S	5	5	5	15
Others	N	0	0	0	0	0
	C	5	5	5	5	20
	N	11,580	13,712	13,736	14,810	53,838
	C	3,142	3,582	4,207	5,237	16,168
Total		14,722	17,294	17,943	20,047	70,006

(Continued)

MOS EPROM--Data

Table 6 (Continued)
256K MOS EPROM Shipment Data, 1983-1987

	1986				Year
	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
Percentage Change from Previous Quarter	60%	17%	4%	12%	
Cumulative Total	39,282	56,576	74,519	94,566	
ASPs: NMOS	\$4.14	\$4.50	\$4.50	\$4.20	\$4.34
CMOS	\$5.00	\$5.50	\$5.50	\$5.25	\$5.32
Overall	\$4.32	\$4.71	\$4.73	\$4.47	\$4.57
Revenue (\$M)	63.7	81.4	85.0	89.7	319.7
	1986				Year
	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
Market Share					
U.S.	38.6%	39.6%	42.4%	41.2%	40.6%
Japan	61.4	59.6	57.5	58.7	59.2
Europe	0.0	0.8	0.1	0.0	0.2
Total	100.0%	100.0%	100.0%	100.0%	100.0%

S = Sampling

N/A = Not Available

Columns may not add to totals shown because of rounding.

(Continued)

MOS EPROM--Data

Table 6 (Continued)
256K MOS EPROM Shipment Data, 1983-1987

Company	MOS Process	1987				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	1,585	1,850	1,600	2,175	7,210
	C	0	10	100	400	510
Fujitsu	N	900	800	950	900	3,550
	C	700	1,700	2,050	2,500	6,950
Hitachi	N	2,500	2,500	1,500	0	6,500
	C	2,200	2,000	2,000	0	6,200
	C OTP	0	0	0	0	0
Intel	N	4,500	5,400	4,300	4,600	18,800
	C	450	500	370	260	1,580
	N OTP	800	1,200	1,000	950	3,950
	C OTP	100	50	250	170	570
Microchip Tech., Inc.	N	600	700	700	800	2,800
	C	900	1,000	1,000	300	3,200
	OTP	200	200	400	100	900
Mitsubishi	N	1,300	1,800	2,200	1,750	7,050
	C	400	500	750	1,050	2,700
	N OTP	950	450	800	550	2,750
	C OTP	0	0	50	130	180
National Semi.	C	654	1,257	1,606	3,510	7,027
NEC	N	690	540	360	400	1,990
	C	1,090	870	1,600	1,250	4,810
Oki Electric	N	100	100	100	50	350
	N OTP	800	800	800	800	3,200
Ricoh	C	5	5	10	20	40
Seeq	C	75	75	75	75	300
Seiko-Epson	C	20	20	20	10	70
SGS-Thomson	N	836	1,162	1,170	1,600	4,768
Signetics	C	200	250	300	300	1,050
Texas Instrument	C	1,500	1,500	1,800	2,000	6,800
Toshiba	N	800	800	1,000	1,500	4,100
	C	500	800	1,200	1,000	3,500
	N OTP	1,400	1,500	1,000	1,000	4,900
	C OTP	200	400	400	400	1,400
VLSI Technology	C	25	30	30	50	135
WaferScale Integ.	C	15	20	20	30	85
	N	17,761	19,602	17,480	17,075	71,918
	C	9,234	11,187	14,031	13,555	48,007
Total		26,995	30,789	31,511	30,630	119,925

(Continued)

MOS EPROM--Data

Table 6 (Continued)

256K MOS EPROM Shipment Data, 1983-1987

	1987				Year
	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
Percentage Change from Previous Quarter	35%	14%	2%	(3%)	
Cumulative Total	121,561	152,350	183,861	214,491	
ASPs: NMOS	\$4.25	\$4.35	\$4.40	\$4.45	\$4.36
CMOS	\$4.90	\$5.00	\$5.10	\$5.10	\$5.04
Overall	\$4.47	\$4.59	\$4.71	\$4.74	\$4.63
Revenue (\$M)	120.7	141.2	148.5	145.1	555.5

	1987				Year
	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
Market Share					
U.S.	43.0%	45.6%	43.0%	51.3%	45.8%
Japan	53.9	50.6	53.3	43.5	50.2
Europe	3.1	3.8	3.7	5.2	4.0
Total	100.0%	100.0%	100.0%	100.0%	100.0%

S = Sampling

N/A = Not Available

Columns may not add to totals shown because of rounding.

Source: Dataquest
April 1988

MOS EPROM--Data

Table 7

512K MOS EPROM Shipment Data, 1984-1987

Company	MOS Process	1984				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	S	2	2	4	8
Fujitsu	N	N/A	N/A	N/A	N/A	0
General Instrument	C	N/A	N/A	N/A	N/A	0
Hitachi	N	N/A	N/A	N/A	N/A	0
	C	N/A	N/A	N/A	N/A	0
Intel	N	N/A	S	2	6	8
Mitsubishi	N	N/A	N/A	N/A	N/A	0
Toshiba	N	N/A	N/A	N/A	N/A	0
	C	N/A	N/A	N/A	N/A	0
VLSI Technology	C	N/A	N/A	N/A	N/A	0
WaferScale Integ.	C	N/A	N/A	N/A	N/A	0
	N	0	2	4	10	16
	C	0	0	0	0	0
Total		0	2	4	10	16
Percentage Change from Previous Quarter						
		0	0	100%	150%	
Cumulative Total						
		0	2	6	16	
ASPs:	MMOS	\$250.00	\$150.00	\$120.30	\$95.00	\$100.13
	CMOS	0	0	0	0	0
	Overall	\$250.00	\$150.00	\$120.00	\$95.00	\$100.13
Revenue (\$M)						
		0	0.3	0.5	1.0	1.7
Market Share						
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Year
U.S.		0	100.0%	100.0%	100.0%	100.0%
Japan		0	0	0	0	0
Europe		0	0	0	0	0
Total		0	100.0%	100.0%	100.0%	100.0%

S = Sampling
N/A = Not Available

(Continued)

MOS EPROM--Data

Table 7 (Continued)

512K MOS EPROM Shipment Data, 1984-1987

Company	MOS Process	1985				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	12	30	35	75	152
Fujitsu	N	N/A	N/A	S	10	10
General Instrument	C	N/A	N/A	N/A	N/A	0
Hitachi	N	N/A	N/A	S	15	15
	C	N/A	N/A	N/A	N/A	0
Intel	N	15	50	65	135	265
Mitsubishi	N	N/A	N/A	N/A	N/A	0
Toshiba	N	N/A	N/A	N/A	S	0
	C	N/A	N/A	N/A	N/A	0
VLSI Technology	C	N/A	N/A	N/A	N/A	0
WaferScale Integ.	C	N/A	N/A	N/A	N/A	0
	N	27	80	100	225	432
	C	0	0	0	10	10
Total		27	80	100	235	442
Percentage Change from Previous Quarter						
		170%	196%	25%	135%	
Cumulative Total						
		43	123	223	458	
ASPs: NMOS						
		\$80.00	\$50.00	\$30.00	\$22.00	\$32.66
CMOS						
		0	0	\$45.00	\$25.00	\$25.00
Overall						
		\$80.00	\$50.00	\$30.00	\$22.13	\$32.49
Revenue (\$M)						
		2.2	4.0	3.0	5.2	14.4
Market Share						
		100.0%	100.0%	100.0%	89.4%	94.3%
U.S.						
		0	0	0	10.6	5.7
Japan						
		0	0	0	0	0
Europe						
		100.0%	100.0%	100.0%	100.0%	100.0%
Total						

S = Sampling
N/A = Not Available

(Continued)

MOS EPROM--Data

Table 7 (Continued)

512K MOS EPROM Shipment Data, 1984-1987

Company	MOS Process	1986				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	175	280	540	400	1,395
Fujitsu	C	25	25	25	25	100
General Instrument	C	S	10	25	100	135
	OTP	N/A	N/A	S	S	5
Hitachi	N	N/A	S	60	300	360
	C	N/A	N/A	N/A	N/A	0
Intel	N	250	400	730	900	2,280
Mitsubishi	N	N/A	S	58	365	423
National Semi.	C	N/A	S	0	0	0
Oni Electric	N	N/A	N/A	S	S	0
Texas Instruments	C	N/A	N/A	S	50	50
Toshiba	N	50	150	300	400	900
	OTP	N/A	N/A	S	30	30
VLSI Technology	C	S	0	3	5	8
WaferScale Integ.	C	N/A	N/A	N/A	N/A	0
Others	C	S	S	S	S	15
	N	475	830	1,688	2,395	5,388
	C	25	40	58	190	313
Total		500	870	1,746	2,585	5,701
Percentage Change from Previous Quarter						
		113%	74%	101%	48%	
Cumulative Total						
		956	1,828	3,574	6,159	
ASPs: NMOS						
		\$14.00	\$12.00	\$12.00	\$11.00	\$11.74
CMOS						
		\$16.50	\$15.50	\$15.00	\$13.00	\$13.97
Overall						
		\$14.13	\$12.16	\$12.10	\$11.15	\$11.85
Revenue (\$M)						
		7.1	10.6	21.1	28.8	67.6
Market Share						
		85.0%	79.9%	74.6%	56.7%	68.2%
U.S.		15.0	20.1	25.4	43.3	31.8
Japan		0	0	0	0	0
Europe		0	0	0	0	0
Total		100.0%	100.0%	100.0%	100.0%	100.0%

S = Sampling
N/A = Not Available

(Continued)

MOS EPROM--Data

Table 7 (Continued)

512K MOS EPROM Shipment Data, 1984-1987

Company	MOS Process	1987				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	740	785	525	565	2,615
	C	5	5	25	435	465
Fujitsu	C	500	1,500	1,800	2,100	5,900
Hitachi	N	750	800	850	950	3,350
	C	5	0	0	0	0
Intel	N	800	1,200	1,800	2,700	6,500
Microchip Tech., Inc.	C	100	150	100	100	450
	OTP	10	10	20	20	60
Mitsubishi	N	750	800	1,200	1,450	4,200
National Semi.	C	0	0	0	0	0
NEC	C	N/A	5	0	1,050	1,050
Oki Electric	N	0	180	200	400	780
	N OTP	0	170	200	650	1,020
SGS-Thomson	N	N/A	1	50	350	401
Texas Instruments	C	100	200	300	400	1,000
Toshiba	N	550	500	600	700	2,350
	N OTP	200	180	180	170	730
VLSI Technology	C	5	5	5	8	23
WaferScale Integ.	C	0	0	0	0	0
	N	3,790	4,616	5,605	7,935	21,946
	C	715	1,870	2,250	4,113	8,948
Total		4,505	6,486	7,855	12,048	30,895
Percentage Change from Previous Quarter						
		74%	44%	21%	53%	
Cumulative Total						
		10,664	17,150	25,005	37,053	
ASPs:						
NMOS		\$10.00	\$ 9.00	\$7.78	\$6.80	\$8.07
CMOS		\$11.00	\$10.00	\$9.00	\$7.50	\$8.68
Overall		\$10.16	\$ 9.29	\$8.13	\$7.04	\$8.24
Revenue (\$M)						
		45.8	60.2	63.9	84.8	254.7
Market Share						
U.S.		39.0%	36.3%	35.3%	35.1%	36.0%
Japan		61.0	63.7	64.0	62.0	62.7
Europe		0	0	0.6	2.9	1.3
Total		100.0%	100.0%	100.0%	100.0%	100.0%

S = Sampling
N/A = Not Available

Source: Dataquest
April 1988

MOS EPROM--Data

Table 8

1-Mbit MOS EPROM Shipment Data, 1986-1987

Company	MOS Process	Technology Features	1986				Year
			1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	C	x16	1	1	4	6	12
Atmel	C	N/A	0	0	0	0	0
Fujitsu	C	x8, x16	N/A	S	S	1	1
General Instrument	C	x16	N/A	N/A	N/A	N/A	0
Hitachi	C	x8, x16	S	10	30	75	115
Intel	N	x8, x16	S	5	25	30	60
Motorola	C	N/A	S	S	S	0	0
National Semi.	C	x8, x16	N/A	N/A	N/A	S	0
NEC	C	x16	N/A	S	0	1	1
Oki Electric	C	x16	N/A	N/A	N/A	S	0
Texas Instruments	C	N/A	N/A	N/A	S	S	0
Toshiba	C	x8	N/A	S	5	15	20
Other	C	N/A	N/A	N/A	S	0	0
	N		0	5	25	30	60
	C		<u>1</u>	<u>11</u>	<u>39</u>	<u>98</u>	<u>149</u>
Total			1	16	64	128	209
Percentage Change from Previous Quarter			0	3,100%	300%	100%	
Cumulative Total			1	17	81	209	
ASPs: NMOS			\$110.00	\$80.00	\$50.00	\$42.00	\$48.50
CMOS			\$150.00	\$70.00	\$66.00	\$60.00	\$62.62
Overall			\$150.00	\$73.13	\$59.75	\$55.78	\$58.56
Revenue (\$M)			0.1	1.2	3.8	7.1	12.2
Market Share							
U.S.			100.0%	37.5%	45.3%	28.1%	34.3%
Japan			0	62.5	54.7	71.9	65.7
Europe			0	0	0	0	0
Total			100.0%	100.0%	100.0%	100.0%	100.0%

S = Sampling
N/A = Not Available

(Continued)

MOS EPROM--Data

Table 8 (Continued)

1-Mbit MOS EPROM Shipment Data, 1986-1987

Company	MOS Process	Technology Features	1987				Year
			1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	C	x16	6	10	25	50	91
Fujitsu	C	x8, x16	N/A	S	5	10	15
Hitachi	C	x8, x16	0	70	150	250	470
Intel	N	x8, x16	50	30	80	150	310
Microchip Tech., Inc.	C		N/A	N/A	N/A	N/A	0
Mitsubishi	C	x8, x16	0	5	5	65	75
National Semi.	C	x8, x16	0	0	0	0	0
NEC	C	x8	N/A	0	50	300	350
	C	x16	N/A	0	50	100	150
Oki Electric	C	x8, x16	N/A	N/A	N/A	S	0
SGS-Thomson	C		N/A	N/A	N/A	N/A	0
Texas Instruments	C		0	0	0	0	0
Toshiba	C	x8, x16	20	40	40	50	150
	N		50	30	80	150	310
	C		26	125	325	825	1,301
Total			76	155	405	975	1,611

Percentage Change from
Previous Quarter

104% 161% 141%

Cumulative Total

285 440 845 1,820

ASPs: NMOS
CMOS
Overall

\$26.00 \$24.00 \$24.00 \$24.00 \$24.32
\$40.00 \$32.00 \$28.00 \$26.00 \$27.36
\$30.79 \$30.45 \$27.21 \$25.69 \$26.77

Revenue (\$M)

2.3 4.7 11.0 25.1 43.1

Market Share
U.S.
Japan
Europe

	1987				Year
	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
U.S.	73.7%	25.8%	25.9%	20.5%	24.9%
Japan	26.3	74.2	74.1	79.5	75.1
Europe	0	0	0	0	0
Total	100.0%	100.0%	100.0%	100.0%	100.0%

S = Sampling
N/A = Not Available

Source: Dataquest
April 1988

MOS EPROM--Data

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MOS EPROM--Data

QUARTERLY COMPANY MOS EPROM SHIPMENT DATA

This section contains unit shipment data on MOS EPROMs from 1976 through 1987. In addition to unit shipments for 8K, 16K, 32K, 64K, 128K, 256K, 512K, and 1-Mbit EPROMs, we have added our estimates of the worldwide billing prices for each product during the four quarters of the year. At the bottom of each table, we show market share data (units, not revenue) for companies based in the United States, Japan, and Europe. The tables are organized as follows:

- Table 1—8K MOS EPROM Shipment Data, 1976–1985
- Table 2—16K MOS EPROM Shipment Data, 1976–1987
- Table 3—32K MOS EPROM Shipment Data, 1978–1987
- Table 4—64K MOS EPROM Shipment Data, 1980–1987
- Table 5—128K MOS EPROM Shipment Data, 1982–1987
- Table 6—256K MOS EPROM Shipment Data, 1983–1987
- Table 7—512K MOS EPROM Shipment Data, 1984–1987
- Table 8—1-Mbit MOS EPROM Shipment Data, 1986–1987

Definitions

Prices

Prices are Dataquest estimates of the billing prices during each quarter. These prices are averaged over all package types, lot sizes, and the entire speed mix, and they represent sales to both military and commercial accounts.

Quarterly Revenue

Quarterly revenue is calculated as units shipped times the prevailing price during that period. We have not, at this time, reconciled the sum of the quarterly shipments by product with the top-level product or MOS memory total. Doing so would undoubtedly force some changes in units, ASPs, or both.

OTP EPROM Data

Included in the 1986 and 1987 data are OTP EPROM shipments.

MOS EPROM--Data

Table 1

8K MOS EPROM Shipment Data, 1976-1985

<u>Company</u>	<u>1976</u>				<u>Year</u>
	<u>1st</u> <u>Qtr.</u>	<u>2nd</u> <u>Qtr.</u>	<u>3rd</u> <u>Qtr.</u>	<u>4th</u> <u>Qtr.</u>	
AMD					
Electronic Arrays	N/A	N/A	N/A	S	S
Fairchild	N/A	N/A	N/A	N/A	N/A
Fujitsu	N/A	N/A	N/A	S	S
Intel	S	25	75	125	225
Mitsubishi	N/A	N/A	N/A	N/A	N/A
Motorola	N/A	N/A	N/A	N/A	N/A
National Semi.	N/A	N/A	N/A	N/A	N/A
Oki Electric	N/A	N/A	N/A	N/A	N/A
Texas Instruments	N/A	N/A	S	5	5
Toshiba	N/A	S	20	50	70
Total	S	25	95	180	300
Percentage Change from Previous Quarter	0%	0%	280%	89%	
Cumulative Total	0	25	120	300	
Average Selling Price	\$80.00	\$50.00	\$35.00	\$30.00	\$33.25
Revenue (\$M)	0	1.3	3.3	5.4	10.0

	<u>1976</u>				<u>Year</u>
	<u>1st</u> <u>Qtr.</u>	<u>2nd</u> <u>Qtr.</u>	<u>3rd</u> <u>Qtr.</u>	<u>4th</u> <u>Qtr.</u>	
Market Share					
U.S.	0	100.0%	78.9%	72.2%	76.7%
Japan	0	0	21.1	27.8	23.3
Europe	0	0	0	0	0
Total	0	100.0%	100.0%	100.0%	100.0%

N/A = Not Available
S = Sampling

(Continued)

MOS EPROM--Data

Table 1 (Continued)
8K MOS EPROM Shipment Data, 1976-1985

<u>Company</u>	<u>1977</u>				<u>Year</u>
	<u>1st</u> <u>Qtr.</u>	<u>2nd</u> <u>Qtr.</u>	<u>3rd</u> <u>Qtr.</u>	<u>4th</u> <u>Qtr.</u>	
AMD					
Electronic Arrays	10	15	50	75	150
Fairchild	0	0	0	5	5
Fujitsu	10	15	25	40	90
Intel	200	325	475	600	1,600
Mitsubishi	N/A	N/A	N/A	N/A	N/A
Motorola	S	15	20	35	70
National Semi.	S	25	40	85	150
Oki Electric	N/A	N/A	N/A	N/A	N/A
Texas Instruments	15	25	40	70	150
Toshiba	<u>100</u>	<u>100</u>	<u>200</u>	<u>300</u>	<u>700</u>
Total	335	520	850	1,210	2,915
Percentage Change from Previous Quarter	86%	55%	63%	42%	
Cumulative Total	635	1,155	2,005	3,215	
Average Selling Price	\$30.00	\$25.00	\$21.00	\$18.00	\$21.50
Revenue (\$M)	10.1	13.0	17.9	21.8	62.7
	<u>1977</u>				<u>Year</u>
	<u>1st</u> <u>Qtr.</u>	<u>2nd</u> <u>Qtr.</u>	<u>3rd</u> <u>Qtr.</u>	<u>4th</u> <u>Qtr.</u>	
Market Share					
U.S.	67.2%	77.9%	73.5%	71.9%	72.9%
Japan	32.8	22.1	26.5	28.1	27.1
Europe	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total	100.0%	100.0%	100.0%	100.0%	100.0%

N/A = Not Available
S = Sampling

(Continued)

MOS EPROM--Data

Table 1 (Continued)
8K MOS EPROM Shipment Data, 1976-1985

<u>Company</u>	<u>1978</u>				<u>Year</u>
	<u>1st</u> <u>Qtr.</u>	<u>2nd</u> <u>Qtr.</u>	<u>3rd</u> <u>Qtr.</u>	<u>4th</u> <u>Qtr.</u>	
AMD	15	50	80	340	485
Electronic Arrays	30	50	60	60	200
Fairchild	40	60	60	120	280
Fujitsu	50	90	70	70	280
Intel	700	900	800	1,000	3,400
Mitsubishi	50	125	175	250	600
Motorola	100	250	250	420	1,020
National Semi.	275	260	310	405	1,250
Oki Electric	N/A	N/A	N/A	N/A	N/A
Texas Instruments	350	550	400	800	2,100
Toshiba	<u>N/A</u>	<u>N/A</u>	<u>10</u>	<u>30</u>	<u>40</u>
Total	1,610	2,335	2,215	3,495	9,655
Percentage Change from Previous Quarter	33%	45%	(5%)	58%	
Cumulative Total	4,825	7,160	9,375	12,870	
Average Selling Price	\$15.00	\$ 9.00	\$ 5.00	\$ 4.50	\$ 7.45
Revenue (\$M)	24.2	21.0	11.1	15.7	72.0
	<u>1978</u>				<u>Year</u>
	<u>1st</u> <u>Qtr.</u>	<u>2nd</u> <u>Qtr.</u>	<u>3rd</u> <u>Qtr.</u>	<u>4th</u> <u>Qtr.</u>	
Market Share					
U.S.	93.8%	90.8%	88.5%	90.0%	90.5%
Japan	6.2	9.2	11.5	10.0	9.5
Europe	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total	100.0%	100.0%	100.0%	100.0%	100.0%

N/A = Not Available

(Continued)

MOS EPROM--Data

Table 1 (Continued)
8K MOS EPROM Shipment Data, 1976-1985

<u>Company</u>	<u>1979</u>				<u>Year</u>
	<u>1st</u> <u>Qtr.</u>	<u>2nd</u> <u>Qtr.</u>	<u>3rd</u> <u>Qtr.</u>	<u>4th</u> <u>Qtr.</u>	
AMD	600	700	700	500	2,500
Electronic Arrays	75	100	125	35	335
Fairchild	160	200	350	600	1,310
Fujitsu	70	50	50	50	220
Intel	1,100	1,400	1,400	1,100	5,000
Mitsubishi	190	240	240	270	940
Motorola	700	750	1,000	1,000	3,450
National Semi.	600	800	800	900	3,100
Oki Electric	N/A	N/A	N/A	N/A	N/A
Texas Instruments	800	800	800	800	3,200
Toshiba	50	100	100	50	300
Total	4,345	5,140	5,565	5,305	20,355
Percentage Change from Previous Quarter	24%	18%	8%	(5%)	
Cumulative Total	17,215	22,355	27,920	33,225	
Average Selling Price	\$6.00	\$8.00	\$7.00	\$5.50	\$6.65
Revenue (\$M)	26.1	41.1	39.0	29.2	135.3
	<u>1979</u>				<u>Year</u>
	<u>1st</u> <u>Qtr.</u>	<u>2nd</u> <u>Qtr.</u>	<u>3rd</u> <u>Qtr.</u>	<u>4th</u> <u>Qtr.</u>	
Market Share					
U.S.	92.9%	92.4%	93.0%	93.0%	92.8%
Japan	7.1	7.6	7.0	7.0	7.2
Europe	0	0	0	0	0
Total	100.0%	100.0%	100.0%	100.0%	100.0%

N/A = Not Available

(Continued)

MOS EPROM--Data

Table 1 (Continued)

8K MOS EPROM Shipment Data, 1976-1985

<u>Company</u>	<u>1980</u>				<u>Year</u>
	<u>1st</u> <u>Qtr.</u>	<u>2nd</u> <u>Qtr.</u>	<u>3rd</u> <u>Qtr.</u>	<u>4th</u> <u>Qtr.</u>	
AMD	600	700	650	350	2,300
Electronic Arrays	0	0	0	0	0
Fairchild	750	1,000	850	600	3,200
Fujitsu	50	50	50	50	200
Intel	700	500	500	250	1,950
Mitsubishi	160	60	90	80	390
Motorola	500	500	350	250	1,600
National Semi.	1,000	1,000	700	600	3,300
Oki Electric	N/A	N/A	N/A	S	N/A
Texas Instruments	800	600	600	580	2,580
Toshiba	<u>35</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>35</u>
Total	4,595	4,410	3,790	2,760	15,555
Percentage Change from Previous Quarter	(13%)	(4%)	(14%)	(27%)	
Cumulative Total	37,820	42,230	46,020	48,780	
Average Selling Price	\$5.00	\$4.50	\$4.50	\$3.00	\$4.38
Revenue (\$M)	23.0	19.8	17.1	8.3	68.2
	<u>1980</u>				<u>Year</u>
	<u>1st</u> <u>Qtr.</u>	<u>2nd</u> <u>Qtr.</u>	<u>3rd</u> <u>Qtr.</u>	<u>4th</u> <u>Qtr.</u>	
Market Share					
U.S.	94.7%	97.5%	96.3%	95.3%	96.0%
Japan	5.3	2.5	3.7	4.7	4.0
Europe	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total	100.0%	100.0%	100.0%	100.0%	100.0%

N/A = Not Available

S = Sampling

(Continued)

MOS EPROM--Data

Table 1 (Continued)
8K MOS EPROM Shipment Data, 1976-1985

<u>Company</u>	<u>1981</u>				<u>Year</u>
	<u>1st</u> <u>Qtr.</u>	<u>2nd</u> <u>Qtr.</u>	<u>3rd</u> <u>Qtr.</u>	<u>4th</u> <u>Qtr.</u>	
AMD	500	200	200	190	1,090
Electronic Arrays	0	0	0	0	0
Fairchild	300	240	150	50	740
Fujitsu	50	20	10	0	80
Intel	200	150	100	50	500
Mitsubishi	110	40	30	25	205
Motorola	150	175	150	220	695
National Semi.	400	350	200	100	1,050
Oki Electric	50	50	70	50	220
Texas Instruments	550	400	300	200	1,450
Toshiba	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total	2,310	1,625	1,210	885	6,030
Percentage Change from Previous Quarter	(16%)	(30%)	(26%)	(27%)	
Cumulative Total	51,090	52,715	53,925	54,810	
Average Selling Price	\$3.50	\$3.00	\$2.50	\$2.00	\$2.94
Revenue (\$M)	8.1	4.9	3.0	1.8	17.8
	<u>1981</u>				<u>Year</u>
	<u>1st</u> <u>Qtr.</u>	<u>2nd</u> <u>Qtr.</u>	<u>3rd</u> <u>Qtr.</u>	<u>4th</u> <u>Qtr.</u>	
Market Share					
U.S.	90.9%	93.2%	90.9%	91.5%	91.6%
Japan	9.1	6.8	9.1	8.5	8.4
Europe	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total	100.0%	100.0%	100.0%	100.0%	100.0%

(Continued)

MOS EPROM--Data

Table 1 (Continued)

8K MOS EPROM Shipment Data, 1976-1985

<u>Company</u>	<u>1982</u>				<u>Year</u>
	<u>1st</u> <u>Qtr.</u>	<u>2nd</u> <u>Qtr.</u>	<u>3rd</u> <u>Qtr.</u>	<u>4th</u> <u>Qtr.</u>	
AMD	180	100	100	50	430
Electronic Arrays	0	0	0	0	0
Fairchild	30	5	0	0	35
Fujitsu	0	0	0	0	0
Intel	15	5	0	0	20
Mitsubishi	20	15	30	0	65
Motorola	200	160	250	150	760
National Semi.	70	50	50	50	220
Oki Electric	30	25	15	25	95
Texas Instruments	100	70	35	25	230
Toshiba	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total	645	430	480	300	1,855
Percentage Change from Previous Quarter	(27%)	(33%)	12%	(38%)	
Cumulative Total	55,455	55,885	56,365	56,665	
Average Selling Price	\$3.50	\$3.50	\$3.25	\$3.25	\$3.39
Revenue (\$M)	2.3	1.5	1.6	1.0	6.3
	<u>1982</u>				<u>Year</u>
	<u>1st</u> <u>Qtr.</u>	<u>2nd</u> <u>Qtr.</u>	<u>3rd</u> <u>Qtr.</u>	<u>4th</u> <u>Qtr.</u>	
Market Share					
U.S.	92.2%	90.7%	90.6%	91.7%	91.4%
Japan	7.8	9.3	9.4	8.3	8.6
Europe	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total	100.0%	100.0%	100.0%	100.0%	100.0%

(Continued)

MOS EPROM--Data

Table 1 (Continued)
8K MOS EPROM Shipment Data, 1976-1985

<u>Company</u>	<u>1983</u>				<u>Year</u>
	<u>1st</u> <u>Qtr.</u>	<u>2nd</u> <u>Qtr.</u>	<u>3rd</u> <u>Qtr.</u>	<u>4th</u> <u>Qtr.</u>	
AMD	100	100	50	50	300
Electronic Arrays	0	0	0	0	0
Fairchild	0	0	0	0	0
Fujitsu	0	0	0	0	0
Intel	0	0	0	0	0
Mitsubishi	0	0	0	0	0
Motorola	120	100	70	0	290
National Semi.	50	50	25	25	150
Oki Electric	0	0	0	0	0
Texas Instruments	0	0	0	0	0
Toshiba	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total	270	250	145	75	740
Percentage Change from Previous Quarter	(10%)	(7%)	(42%)	(48%)	
Cumulative Total	56,935	57,185	57,330	57,405	
Average Selling Price	\$3.50	\$4.00	\$4.00	\$4.25	\$3.84
Revenue (\$M)	0.9	1.0	0.6	0.3	2.8
	<u>1983</u>				<u>Year</u>
	<u>1st</u> <u>Qtr.</u>	<u>2nd</u> <u>Qtr.</u>	<u>3rd</u> <u>Qtr.</u>	<u>4th</u> <u>Qtr.</u>	
Market Share					
U.S.	100.0%	100.0%	100.0%	100.0%	100.0%
Japan	0	0	0	0	0
Europe	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total	100.0%	100.0%	100.0%	100.0%	100.0%

(Continued)

MOS EPROM--Data

Table 1 (Continued)

8K MOS EPROM Shipment Data, 1976-1985

<u>Company</u>	<u>1984</u>				<u>Year</u>
	<u>1st</u> <u>Qtr.</u>	<u>2nd</u> <u>Qtr.</u>	<u>3rd</u> <u>Qtr.</u>	<u>4th</u> <u>Qtr.</u>	
AMD	80	130	30	20	260
Electronic Arrays	0	0	0	0	0
Fairchild	0	0	0	0	0
Fujitsu	0	0	0	0	0
Intel	0	0	0	0	0
Mitsubishi	0	0	0	0	0
Motorola	0	0	0	0	0
National Semi.	25	0	0	0	25
Oki Electric	0	0	0	0	0
Texas Instruments	0	0	0	0	0
Toshiba	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total	105	130	30	20	285
Percentage Change from Previous Quarter	40%	24%	(77%)	(33%)	
Cumulative Total	57,510	57,640	57,670	57,690	
Average Selling Price	\$4.00	\$4.00	\$4.00	\$5.00	\$4.07
Revenue (\$M)	0.4	0.5	0.1	0.1	1.2
	<u>1984</u>				<u>Year</u>
	<u>1st</u> <u>Qtr.</u>	<u>2nd</u> <u>Qtr.</u>	<u>3rd</u> <u>Qtr.</u>	<u>4th</u> <u>Qtr.</u>	
Market Share					
U.S.	100.0%	100.0%	100.0%	100.0%	100.0%
Japan	0	0	0	0	0
Europe	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total	100.0%	100.0%	100.0%	100.0%	100.0%

(Continued)

MOS EPROM---Data

Table 1 (Continued)

8K MOS EPROM Shipment Data, 1976-1985

<u>Company</u>	<u>1985</u>				<u>Year</u>
	<u>1st</u> <u>Qtr.</u>	<u>2nd</u> <u>Qtr.</u>	<u>3rd</u> <u>Qtr.</u>	<u>4th</u> <u>Qtr.</u>	
AMD	15	10	5	5	35
Electronic Arrays	0	0	0	0	0
Fairchild	0	0	0	0	0
Fujitsu	0	0	0	0	0
Intel	0	0	0	0	0
Mitsubishi	0	0	0	0	0
Motorola	0	0	0	0	0
National Semi.	0	0	0	0	0
Oki Electric	0	0	0	0	0
Texas Instruments	0	0	0	0	0
Toshiba	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total	15	10	5	5	35

Percentage Change from Previous Quarter	(25%)	(33%)	(50%)	0%	
Cumulative Total	57,705	57,715	57,720	57,725	
Average Selling Price	\$5.50	\$6.00	\$7.00	\$8.00	\$6.21
Revenue (\$M)	0.1	0.1	0	0	0.2

	<u>1985</u>				<u>Year</u>
	<u>1st</u> <u>Qtr.</u>	<u>2nd</u> <u>Qtr.</u>	<u>3rd</u> <u>Qtr.</u>	<u>4th</u> <u>Qtr.</u>	
Market Share					
U.S.	100.0%	100.0%	100.0%	100.0%	100.0%
Japan	0	0	0	0	0
Europe	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total	100.0%	100.0%	100.0%	100.0%	100.0%

Source: Dataquest
April 1988

MOS EPROM--Data

Table 2

16K MOS EPROM Shipment Data, 1976-1987

Company	MOS Process	1976				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	N/A	N/A	N/A	N/A	N/A
Eurotechnique	C	N/A	N/A	N/A	N/A	N/A
Fairchild	N	N/A	N/A	N/A	N/A	N/A
Fujitsu	N	N/A	N/A	N/A	N/A	N/A
Hitachi	N	N/A	N/A	N/A	N/A	N/A
Intel	N	N/A	N/A	S	10	10
Matsushita	N	N/A	N/A	N/A	N/A	N/A
Mitsubishi	N	N/A	N/A	N/A	N/A	N/A
Mostek	N	N/A	N/A	N/A	N/A	N/A
Motorola	N	N/A	N/A	N/A	N/A	N/A
National Semi.	N	N/A	N/A	N/A	N/A	N/A
NEC	C	N/A	N/A	N/A	N/A	N/A
Oki Electric	N	N/A	N/A	N/A	N/A	N/A
SGS-Ates	N	N/A	N/A	N/A	N/A	N/A
Synectek	N	N/A	N/A	N/A	N/A	N/A
Texas Instruments	N	N/A	N/A	N/A	5	5
Toshiba	N	N/A	N/A	N/A	N/A	N/A
	N	0	0	0	15	15
	C	0	0	0	0	0
Total		0	0	0	15	15
Percentage Change from Previous Quarter						
Cumulative Total						
		0	0	0	15	
ASPs: NMOS		\$50.00	\$50.00	\$50.00	\$50.00	\$50.00
CMOS		0	0	0	0	0
Overall		\$50.00	\$50.00	\$50.00	\$50.00	\$50.00
Revenue (\$M)		0	0	0	0.8	0.8
Market Share						
U.S.						
		0	0	0	100.0%	100.0%
Japan						
		0	0	0	0	0
Europe						
		0	0	0	0	0
Total		0	0	0	100.0%	100.0%

S = Sampling
N/A = Not Available

(Continued)

MOS EPROM--Data

Table 2 (Continued)

16K MOS EPROM Shipment Data, 1976-1987

Company	MOS Process	1977				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	N/A	N/A	N/A	N/A	N/A
Burotechnique	C	N/A	N/A	N/A	N/A	N/A
Fairchild	N	N/A	N/A	N/A	N/A	N/A
Fujitsu	N	N/A	N/A	N/A	N/A	N/A
Hitachi	N	N/A	N/A	N/A	N/A	N/A
Intel	N	40	75	100	125	340
Matsushita	N	N/A	N/A	N/A	N/A	N/A
Mitsubishi	N	N/A	N/A	N/A	N/A	N/A
Mostek	N	N/A	N/A	N/A	N/A	N/A
Motorola	N	N/A	N/A	N/A	N/A	N/A
National Semi.	N	N/A	N/A	N/A	N/A	N/A
	C	N/A	N/A	N/A	N/A	N/A
NEC	N	N/A	N/A	N/A	N/A	N/A
OKi Electric	N	N/A	N/A	N/A	N/A	N/A
SGS-Ates	N	N/A	N/A	N/A	N/A	N/A
Synertek	N	N/A	N/A	N/A	N/A	N/A
Texas Instruments	N	20	25	30	55	130
Toshiba	N	N/A	N/A	N/A	N/A	N/A
	N	60	100	130	180	470
	C	0	0	0	0	0
Total		60	100	130	180	470
Percentage Change from Previous Quarter						
		0	67%	30%	38%	
Cumulative Total						
		75	175	305	485	
ASPs: NMOS						
		\$45.00	\$45.00	\$30.00	\$30.00	\$35.11
CMOS						
		0	0	0	0	0
Overall						
		\$45.00	\$45.00	\$30.00	\$30.00	\$35.11
Revenue (\$M)						
		2.7	4.5	3.9	5.4	16.5
Market Share						
		100.0%	100.0%	100.0%	100.0%	100.0%
U.S.						
		0	0	0	0	0
Japan						
		0	0	0	0	0
Europe						
		0	0	0	0	0
Total		100.0%	100.0%	100.0%	100.0%	100.0%

N/A = Not Available

(Continued)

MOS EPROM--Data

Table 2 (Continued)

16K MOS EPROM Shipment Data, 1976-1987

Company	MOS Process	1978				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	N/A	N/A	N/A	N/A	0
Eurotechnique	C	N/A	N/A	N/A	N/A	0
Fairchild	N	N/A	N/A	N/A	N/A	0
Fujitsu	N	N/A	N/A	N/A	5	5
Hitachi	N	N/A	N/A	5	30	35
Intel	N	250	400	250	450	1,350
Matsushita	N	N/A	N/A	N/A	N/A	0
Mitsubishi	N	N/A	N/A	N/A	N/A	0
Mostek	N	S	S	S	25	25
Motorola	N	N/A	S	10	90	100
National Semi.	N	N/A	N/A	S	S	0
	C	N/A	N/A	N/A	N/A	0
NEC	N	N/A	N/A	N/A	N/A	0
Oki Electric	N	N/A	N/A	N/A	N/A	0
SGS-Ates	N	N/A	N/A	N/A	N/A	0
Synertek	N	N/A	N/A	N/A	N/A	0
Texas Instruments	N	100	250	200	300	850
Toshiba	N	N/A	N/A	S	5	5
	N	350	650	465	905	2,370
	C	0	0	0	0	0
Total		350	650	465	905	2,370
Percentage Change from Previous Quarter						
		94%	86%	(28%)	95%	
Cumulative Total						
		835	1,485	1,950	2,855	
ASPs: NMOS						
		\$28.00	\$25.00	\$25.00	\$15.00	\$21.62
CMOS						
		0	0	0	0	0
Overall						
		\$28.00	\$25.00	\$25.00	\$15.00	\$21.62
Revenue (\$M)						
		9.8	16.3	11.6	13.6	51.3
Market Share						
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Year
U.S.		100.0%	100.0%	98.9%	95.6%	98.1%
Japan		0	0	1.1	4.4	1.9
Europe		0	0	0	0	0
Total		100.0%	100.0%	100.0%	100.0%	100.0%

S = Sampling
N/A = Not Available

(Continued)

MOS EPROM--Data

Table 2 (Continued)

16K MOS EPROM Shipment Data, 1976-1987

Company	MOS Process	1979				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	N/A	S	5	10	15
Burrotechnique	C	N/A	N/A	N/A	N/A	0
Fairchild	N	N/A	N/A	N/A	N/A	0
Fujitsu	N	70	200	300	300	870
Hitachi	N	125	200	350	500	1,175
Intel	N	550	750	800	900	3,000
Matsushita	N	N/A	N/A	N/A	N/A	0
Mitsubishi	N	10	20	50	90	170
Mostek	N	90	150	250	350	840
Motorola	N	160	150	160	200	670
National Semi.	N	5	50	80	120	255
	C	N/A	N/A	N/A	N/A	0
NBC	N	N/A	N/A	N/A	5	5
Oki Electric	N	N/A	N/A	N/A	N/A	0
SGS-Ates	N	N/A	N/A	N/A	N/A	0
Synertek	N	N/A	N/A	N/A	8	0
Texas Instruments	N	400	900	1,100	1,800	4,200
Toshiba	N	25	50	90	200	365
	N	1,435	2,470	3,185	4,475	11,565
	C	0	0	0	0	0
Total		1,435	2,470	3,185	4,475	11,565
Percentage Change from Previous Quarter						
		59%	72%	29%	41%	
Cumulative Total						
		4,290	6,760	9,945	14,420	
ASPs: NMOS						
		\$17.00	\$22.00	\$19.00	\$17.00	\$18.62
CMOS						
		0	0	0	0	0
Overall						
		\$17.00	\$22.00	\$19.00	\$17.00	\$18.62
Revenue (\$M)						
		24.4	54.3	60.5	76.1	215.3
Market Share						
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Year
U.S.						
		84.0%	81.0%	75.2%	75.5%	77.6%
Japan						
		16.0	19.0	24.8	24.5	22.4
Europe						
		0	0	0	0	0
Total		100.0%	100.0%	100.0%	100.0%	100.0%

S = Sampling
N/A = Not Available

(Continued)

MOS EPROM--Data

Table 2 (Continued)

16K MOS EPROM Shipment Data, 1976-1987

Company	MOS Process	1980				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	25	50	100	175	350
Eurotechnique	C	N/A	N/A	N/A	N/A	0
Fairchild	N	30	300	300	250	880
Fujitsu	N	350	750	700	650	2,450
Hitachi	N	700	850	1,025	1,325	3,900
Intel	N	950	1,000	1,700	1,850	5,500
Matsushita	N	8	50	50	80	180
Mitsubishi	N	210	260	270	410	1,150
Mostek	N	275	250	350	450	1,325
Motorola	N	250	350	500	500	1,600
National Semi.	N	250	250	300	425	1,225
	C	N/A	N/A	N/A	N/A	0
NEC	N	10	25	50	125	210
Oki Electric	N	8	0	0	0	0
SGS-Ates	N	1,800	0	0	5	1,805
Synertek	N	200	25	10	0	235
Texas Instruments	N	2,000	2,000	2,000	2,100	8,100
Toshiba	N	300	330	350	400	1,380
	N	7,350	6,490	7,705	8,745	30,290
	C	0	0	0	0	0
Total		7,350	6,490	7,705	8,745	30,290
Percentage Change from Previous Quarter						
		64%	(12%)	19%	13%	
Cumulative Total						
		21,770	28,260	35,965	44,710	
ASPs: NMOS						
		\$15.00	\$11.00	\$8.00	\$6.00	\$9.76
CMOS						
		0	0	0	0	0
Overall						
		\$15.00	\$11.00	\$8.00	\$6.00	\$9.76
Revenue (\$M)						
		110.3	71.4	61.6	52.5	295.8
Market Share						
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Year
U.S.		54.1%	65.1%	68.3%	65.8%	63.4%
Japan		21.4	34.9	31.7	34.2	30.6
Europe		24.5	0	0	0.1	6.0
Total		100.0%	100.0%	100.0%	100.0%	100.0%

S = Sampling
N/A = Not Available

(Continued)

MOS EPROM--Data

Table 2 (Continued)

16K MOS EPROM Shipment Data, 1976-1987

Company	MOS Process	1981				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	250	350	485	750	1,835
Eurotechnique	C	N/A	N/A	S	15	15
Fairchild	N	100	20	20	0	140
Fujitsu	N	750	1,000	700	500	2,950
Hitachi	N	1,700	1,700	1,200	700	5,300
Intel	N	2,600	3,000	3,000	3,000	11,600
Matsushita	N	120	150	200	250	720
Mitsubishi	N	580	740	670	520	2,510
Mostek	N	700	600	700	800	2,800
Motorola	N	400	420	500	400	1,720
National Semi.	N	500	550	700	1,100	2,850
	C	N/A	N/A	N/A	N/A	N/A
NEC	N	175	250	600	900	1,925
Oki Electric	N	25	40	80	100	245
SGS-Ates	N	15	25	50	75	165
Synertek	N	0	0	0	0	0
Texas Instruments	N	2,200	2,500	2,200	2,200	9,100
Toshiba	N	90	100	200	350	740
	N	10,205	11,445	11,305	11,645	44,600
	C	0	0	0	15	15
Total		10,205	11,445	11,305	11,660	44,615
Percentage Change from Previous Quarter						
		17%	12%	(1%)	3%	
Cumulative Total						
		54,915	66,360	77,665	89,325	
ASPs:						
NMOS		\$4.50	\$3.50	\$3.00	\$2.50	\$3.34
CMOS		0	0	0	0	0
Overall		\$4.50	\$3.50	\$3.00	\$2.50	\$3.34
Revenue (\$M)						
		45.9	40.1	33.9	29.1	149.0
Market Share						
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Year
U.S.		66.1%	65.0%	67.3%	70.8%	67.3%
Japan		33.7	34.8	32.3	28.5	32.3
Europe		0.1	0.2	0.4	0.8	0.4
Total		100.0%	100.0%	100.0%	100.0%	100.0%

S = Sampling
N/A = Not Available

(Continued)

MOS EPROM--Data

Table 2 (Continued)

16K MOS EPROM Shipment Data, 1976-1987

Company	MOS Process	1982				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	1,000	1,150	1,150	900	4,200
Eurotechnique	C	100	400	500	600	1,600
Fairchild	N	0	0	0	0	0
Fujitsu	N	400	350	250	100	1,100
Hitachi	N	450	250	200	200	1,100
Intel	N	3,000	2,500	1,800	1,200	8,500
Matsushita	N	250	250	150	100	750
Mitsubishi	N	450	350	300	160	1,260
Mostek	N	500	200	250	250	1,200
Motorola	N	250	160	100	60	570
National Semi.	N	1,200	1,250	1,300	2,200	5,950
	C	50	150	200	200	600
NEC	N	900	1,000	1,200	1,200	4,300
Oki Electric	N	250	400	400	400	1,450
SGS-Ates	N	100	180	350	520	1,150
Synartek	N	0	0	0	0	0
Texas Instruments	N	2,000	2,000	1,800	1,800	7,600
Toshiba	N	500	400	300	300	1,500
	N	11,250	10,440	9,550	9,390	40,630
	C	150	550	700	800	2,200
Total		11,400	10,990	10,250	10,190	42,830
Percentage Change from Previous Quarter						
		(2%)	(4%)	(7%)	(1%)	
Cumulative Total		100,725	111,715	121,965	132,155	
ASPs:						
NMOS		\$3.25	\$3.10	\$3.00	\$3.00	\$3.09
CMOS		0	0	0	0	0
Overall		\$3.25	\$3.10	\$3.00	\$3.00	\$3.09
Revenue (\$M)		36.6	32.4	28.7	28.2	125.7
Market Share						
U.S.		70.2%	67.4%	64.4%	64.9%	66.8%
Japan		28.1	27.3	27.3	24.1	26.8
Europe		1.8	5.3	8.3	11.0	6.4
Total		100.0%	100.0%	100.0%	100.0%	100.0%

(Continued)

MOS EPROM--Data

Table 2 (Continued)

16K MOS EPROM Shipment Data, 1976-1987

Company	MOS Process	1983				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	700	700	1,000	1,200	3,600
Eurotechnique	C	200	200	200	200	800
Fairchild	N	0	0	0	0	0
Fujitsu	N	50	50	0	0	100
Hitachi	N	100	100	50	0	250
Intel	N	1,000	1,000	800	700	3,500
Matsushita	N	100	100	100	100	400
Mitsubishi	N	180	120	160	130	590
Mostek	N	200	150	150	50	550
Motorola	N	50	80	30	0	160
National Semi.	N	2,150	2,500	2,500	2,800	9,950
	C	350	500	500	700	2,050
NEC	N	2,000	2,500	2,700	1,500	8,700
Oki Electric	N	400	400	350	350	1,500
SGS-Ates	N	500	800	800	900	3,000
Synertek	N	0	0	0	0	0
Texas Instruments	N	2,000	2,500	3,000	3,000	10,500
Toshiba	N	200	100	100	100	500
	N	9,630	11,100	11,740	10,830	43,300
	C	550	700	700	900	2,850
Total		10,180	11,800	12,440	11,730	46,150
Percentage Change from Previous Quarter						
		0%	16%	5%	(6%)	
Cumulative Total		142,335	154,135	166,575	178,305	
ASPs:						
NMOS		\$3.00	\$3.15	\$3.25	\$3.35	\$3.19
CMOS		0	0	0	0	0
Overall		\$3.00	\$3.15	\$3.25	\$3.35	\$3.19
Revenue (\$M)		28.9	35.0	38.2	36.3	138.3
Market Share						
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Year
U.S.		63.4%	63.0%	64.1%	72.0%	65.7%
Japan		29.8	28.6	27.8	18.6	26.1
Europe		6.9	8.5	8.0	9.4	8.2
Total		100.0%	100.0%	100.0%	100.0%	100.0%

(Continued)

MOS EPROM--Data

Table 2 (Continued)

16K MOS EPROM Shipment Data, 1976–1987

Company	MOS Process	1984				
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Year
AMD	N	1,000	1,100	1,200	1,300	4,600
Fairchild	N	0	0	0	0	0
Fujitsu	N	0	0	0	0	0
Hitachi	N	0	0	0	0	0
Intel	N	300	150	100	50	600
Matsushita	N	50	50	25	0	125
Mitsubishi	N	130	130	130	100	490
Mostek	N	0	0	0	0	0
Motorola	N	0	0	0	0	0
National Semi.	N	2,800	2,700	2,400	2,000	9,900
	C	700	700	550	400	2,350
NEC	N	1,350	1,200	950	700	4,200
Oki Electric	N	250	250	200	200	900
SGS	N	1,050	600	300	800	2,750
Synertek	N	0	0	0	0	0
Texas Instruments	N	3,500	3,000	2,000	1,800	10,300
Thomson-Eurotechnique	C	200	250	250	250	950
Toshiba	N	0	0	0	0	0
	N	10,430	9,180	7,305	6,950	33,865
	C	900	950	800	650	3,300
Total		11,330	10,130	8,105	7,600	37,165
Percentage Change from Previous Quarter						
		(3%)	(11%)	(20%)	(6%)	
Cumulative Total		189,635	199,765	207,870	215,470	
ASPs:	NMOS	\$3.35	\$3.35	\$3.00	\$2.85	\$3.17
	CMOS	\$5.50	\$5.50	\$5.25	\$4.50	\$5.24
	Overall	\$3.52	\$3.55	\$3.22	\$2.99	\$3.36
Revenue (\$M)		39.9	36.0	26.1	22.7	124.7
Market Share						
		1984				
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Year
U.S.		73.3%	75.5%	77.1%	73.0%	74.7%
Japan		15.7	16.1	16.1	13.2	15.4
Europe		11.0	8.4	6.8	13.8	10.0
Total		100.0%	100.0%	100.0%	100.0%	100.0%

(Continued)

MOS EPROM--Data

Table 2 (Continued)

16K MOS EPROM Shipment Data, 1976-1987

Company	MOS Process	1985				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	1,550	1,850	1,350	1,050	5,800
Fairchild	N	0	0	0	0	0
Fujitsu	N	0	0	0	0	0
Hitachi	N	0	0	0	0	0
Intel	N	0	0	0	0	0
Matsushita	N	0	0	0	0	0
Mitsubishi	N	50	50	0	0	100
Mostek	N	0	0	0	0	0
Motorola	N	0	0	0	0	0
National Semi.	N	1,800	1,600	1,500	1,200	6,100
	C	400	350	400	500	1,650
NEC	N	400	250	800	270	1,720
Oki Electric	N	150	150	100	100	500
SGS	N	750	800	1,100	1,200	3,850
Synertek	N	0	0	0	0	0
Texas Instruments	N	1,500	1,500	1,600	1,600	6,200
Thomson-Eurotechnique	C	350	450	400	500	1,700
Toshiba	N	0	0	0	0	0
	N	6,200	6,200	6,450	5,420	24,270
	C	750	800	800	1,000	3,350
Total		6,950	7,000	7,250	6,420	27,620
Percentage Change from Previous Quarter						
		(9%)	1%	4%	(11%)	
Cumulative Total		222,420	229,420	236,670	243,090	
ASPs: NMOS		\$2.60	\$2.40	\$2.25	\$2.25	\$2.38
CMOS		\$4.00	\$3.50	\$3.25	\$3.25	\$3.48
Overall		\$2.75	\$2.53	\$2.36	\$2.41	\$2.51
Revenue (\$M)		19.1	17.7	17.1	15.4	69.4
Market Share						
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Year
U.S.		75.5%	75.7%	66.9%	67.8%	71.5%
Japan		8.6	6.4	12.4	5.8	8.4
Europe		15.8	17.9	20.7	26.5	20.1
Total		100.0%	100.0%	100.0%	100.0%	100.0%

(Continued)

MOS EPROM--Data

Table 2 (Continued)

16K MOS EPROM Shipment Data, 1976-1987

Company	MOS Process	1986				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	1,000	600	450	375	2,425
Intel	N	250	250	250	250	1,000
National Semi.	N	1,500	1,200	950	800	4,450
NEC	N	180	220	80	40	520
SGS	N	356	189	600	400	1,545
Texas Instruments	N	750	750	400	200	2,100
Thomson	N	1,000	600	600	425	2,625
	N	5,036	3,809	3,330	2,490	14,665
	C	0	0	0	0	0
Total		5,036	3,809	3,330	2,490	14,665
Percentage Change from Previous Quarter		(22%)	(24%)	(13%)	(25%)	
Cumulative Total		248,126	251,935	255,265	257,755	
ASPs:	NMOS	\$2.35	\$2.40	\$2.40	\$2.50	\$2.40
	CMOS	0	0	0	0	0
	Overall	\$2.35	\$2.40	\$2.40	\$2.50	\$2.40
Revenue (\$M)		11.8	9.1	8.0	6.2	35.2
		1986				
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Year
Market Share						
U.S.		69.5%	73.5%	61.6%	65.3%	68.0%
Japan		3.6	5.8	2.4	1.6	3.5
Europe		26.9	20.7	36.0	33.1	28.4
Total		100.0%	100.0%	100.0%	100.0%	100.0%

(Continued)

MOS EPROM--Data

Table 2 (Continued)

16K MOS EPROM Shipment Data, 1976-1987

Company	MOS Process	1987				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	500	350	300	350	1,500
Cypress	C	150	200	200	350	900
Intel	N	200	200	200	200	800
National Semi.	C	158	227	204	195	784
NEC	N	40	40	50	30	160
SGS-Thomson	N	1,195	1,125	1,240	720	4,280
	C	15	70	30	75	190
Texas Instruments	N	200	200	150	150	700
	C	50	50	110	125	335
WaferScale	C	10	25	75	75	185
	N	2,135	1,915	1,940	1,450	7,440
	C	383	572	619	820	2,394
Total		2,518	2,487	2,559	2,270	9,834
Percentage Change from Previous Quarter						
		1%	(1%)	3%	(11%)	
Cumulative Total		260,273	262,760	265,319	267,589	
ASPs:						
NMOS		\$2.55	\$2.60	\$2.65	\$2.70	\$2.62
CMOS		\$4.60	\$2.90	\$3.10	\$3.30	\$3.36
Overall		\$2.86	\$2.67	\$2.76	\$2.92	\$2.80
Revenue (\$M)		7.2	6.6	7.1	6.6	27.5
Market Share						
U.S.		50.4%	50.3%	48.4%	63.7%	52.9%
Japan		1.6	1.6	2.0	1.3	1.6
Europe		48.1	48.0	49.6	35.0	45.5
Total		100.0%	100.0%	100.0%	100.0%	100.0%

Note: Columns may not add to totals shown because of rounding.

Source: Dataquest
April 1988

MOS EPROM--Data

Table 3

32K MOS EPROM Shipment Data, 1978-1987

Company	MOS Process	1978				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	N/A	N/A	N/A	N/A	0
Eurotechnique	C	N/A	N/A	N/A	N/A	0
Fujitsu	N	N/A	N/A	N/A	N/A	0
	C	N/A	N/A	N/A	N/A	0
Hitachi	N	N/A	N/A	N/A	N/A	0
Intel	N	N/A	N/A	N/A	S	0
Mitsubishi	N	N/A	N/A	N/A	N/A	0
Motorola	N	N/A	N/A	N/A	N/A	0
National Semi.	C	N/A	N/A	N/A	N/A	0
NEC	N	N/A	N/A	N/A	N/A	0
Ricoh	C	N/A	N/A	N/A	N/A	0
Rockwell	N	N/A	N/A	N/A	N/A	0
	C	N/A	N/A	N/A	N/A	0
SGS-Ates	N	N/A	N/A	N/A	N/A	0
Texas Instruments	N	N/A	N/A	N/A	5	5
Toshiba	N	N/A	N/A	N/A	N/A	0
	N	0	0	0	5	5
	C	0	0	0	0	0
Total		0	0	0	5	5
Percentage Change from Previous Quarter						
		0	0	0	0	
Cumulative Total						
		0	0	0	5	
ASPs: NMOS						
		0	0	0	0	\$80.00
CMOS						
		0	0	0	0	0
Overall						
		0	0	0	0	\$80.00
Revenue (\$M)						
		0	0	0	0	0
Market Share						
		0	0	0	0	0
U.S.						
		0	0	0	0	0
Japan						
		0	0	0	0	0
Europe						
		0	0	0	0	0
Total		0	0	0	0	0

S = Sampling
N/A = Not Available

(Continued)

MOS EPROM--Data

Table 3 (Continued)

32K MOS EPROM Shipment Data, 1978-1987

Company	MOS Process	1979				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	N/A	N/A	N/A	N/A	0
Eurotechnique	C	N/A	N/A	N/A	N/A	0
Fujitsu	N	N/A	N/A	N/A	S	0
	C	N/A	N/A	N/A	N/A	0
Hitachi	N	N/A	N/A	N/A	S	0
Intel	N	5	30	50	100	185
Mitsubishi	N	N/A	N/A	N/A	S	0
Motorola	N	N/A	N/A	N/A	S	0
National Semi.	C	N/A	N/A	N/A	N/A	0
NEC	N	N/A	N/A	N/A	N/A	0
Ricoh	C	N/A	N/A	N/A	N/A	0
Rockwell	N	N/A	N/A	N/A	N/A	0
	C	N/A	N/A	N/A	N/A	0
SGS-Ates	N	N/A	N/A	N/A	N/A	0
Texas Instruments	N	10	35	60	90	195
Toshiba	N	N/A	N/A	N/A	N/A	0
	N	15	65	110	190	380
	C	0	0	0	0	0
Total		15	65	110	190	380
Percentage Change from Previous Quarter						
		0	333%	69%	73%	.
Cumulative Total						
		20	85	195	385	
ASPs: NMOS						
		\$80.00	\$80.00	\$75.00	\$75.00	\$76.05
CMOS						
		0	0	0	0	0
Overall						
		\$80.00	\$80.00	\$75.00	\$75.00	\$76.05
Revenue (\$M)						
		1.2	5.2	8.3	14.3	28.9
Market Share						
		100.0%	100.0%	100.0%	100.0%	100.0%
U.S.						
		0	0	0	0	0
Japan						
		0	0	0	0	0
Europe						
		0	0	0	0	0
Total		100.0%	100.0%	100.0%	100.0%	100.0%

S = Sampling
N/A = Not Available

(Continued)

MOS EPROM--Data

Table 3 (Continued)

32K MOS EPROM Shipment Data, 1978-1987

Company	MOS Process	1980				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	N/A	N/A	S	2	2
Eurotechnique	C	N/A	N/A	N/A	N/A	0
Fujitsu	N	S	S	15	100	115
	C	N/A	N/A	N/A	N/A	0
Hitachi	N	S	120	220	280	620
Intel	N	165	250	325	450	1,190
Mitsubishi	N	S	6	40	90	136
Motorola	N	S	30	60	50	145
National Semi.	C	S	10	15	15	40
NEC	N	N/A	N/A	5	15	20
Ricoh	C	N/A	N/A	N/A	N/A	0
Rockwell	N	N/A	N/A	N/A	N/A	0
	C	N/A	N/A	N/A	N/A	0
SGS-Ates	N	N/A	N/A	N/A	N/A	0
Texas Instruments	N	150	300	350	450	1,250
Toshiba	N	N/A	S	5	10	15
	N	320	706	1,020	1,447	3,493
	C	0	10	15	15	40
Total		320	716	1,035	1,462	3,533
Percentage Change from Previous Quarter		68%	124%	45%	41%	
Cumulative Total		705	1,421	2,456	3,918	
ASPs:						
NMOS		\$55.00	\$40.00	\$30.00	\$10.00	\$26.03
CMOS		0	0	0	0	0
Overall		\$55.00	\$40.00	\$30.00	\$10.00	\$26.03
Revenue (\$M)		17.6	28.2	30.6	14.5	90.9
		1980				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
Market Share						
U.S.		100.0%	92.4%	72.5%	66.1%	74.4%
Japan		0	17.6	27.5	33.9	25.6
Europe		0	0	0	0	0
Total		100.0%	100.0%	100.0%	100.0%	100.0%

S = Sampling
N/A = Not Available

(Continued)

MOS EPROM--Data

Table 3 (Continued)

32K MOS EPROM Shipment Data, 1978-1987

Company	MOS Process	1981				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	10	100	120	310	540
Eurotechnique	C	N/A	N/A	S	5	5
Fujitsu	N	150	170	600	1,000	1,920
Hitachi	C	N/A	N/A	N/A	N/A	0
Intel	N	500	600	900	1,050	3,050
Mitsubishi	N	600	700	1,050	1,600	3,950
Motorola	N	190	270	270	660	1,390
National Semi.	N	50	120	250	350	770
NEC	C	10	20	30	30	90
Ricoh	N	30	50	325	700	1,105
Rockwell	C	N/A	N/A	N/A	N/A	0
SGS-Ates	N	N/A	N/A	N/A	N/A	0
Texas Instruments	N	N/A	N/A	N/A	N/A	0
Toshiba	N	560	700	900	1,000	3,160
	N	10	25	100	180	315
	N	2,100	2,735	4,515	6,850	16,200
	C	10	20	30	35	95
Total		2,110	2,755	4,545	6,885	16,295
Percentage Change from Previous Quarter		44%	31%	65%	51%	
Cumulative Total		6,020	8,783	13,328	20,213	
ASPs: NMOS		\$9.00	\$8.00	\$7.00	\$5.80	\$6.92
CMOS		0	0	0	0	0
Overall		\$9.00	\$8.00	\$7.00	\$5.80	\$6.92
Revenue (\$M)		18.9	21.9	31.6	39.7	112.1
Market Share						
U.S.		58.3%	59.5%	51.7%	47.8%	52.2%
Japan		41.7	40.5	48.3	52.1	47.7
Europe		0	0	0	0	0
Total		100.0%	100.0%	100.0%	100.0%	100.0%

S = Sampling
N/A = Not Available

(Continued)

MOS EPROM--Data

Table 3 (Continued)

32K MOS EPROM Shipment Data, 1978-1987

Company	MOS Process	1982				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	600	1,050	650	850	3,150
Eurotechnique	C	30	100	150	200	480
Fujitsu	N	600	700	1,000	1,200	3,500
	C	N/A	N/A	N/A	S	0
Hitachi	N	1,500	2,500	2,500	2,500	9,000
Intel	N	2,000	2,500	2,500	2,500	9,500
Mitsubishi	N	1,450	1,500	1,800	1,500	6,250
Motorola	N	325	100	100	0	525
National Semi.	C	75	100	220	250	645
NEC	N	1,300	1,600	2,200	2,300	7,400
Ricoh	C	N/A	N/A	N/A	N/A	0
Rockwell	N	N/A	N/A	N/A	N/A	0
	C	N/A	N/A	N/A	N/A	0
SGS-Ates	N	S	10	25	50	85
Texas Instruments	N	500	600	700	900	2,700
Toshiba	N	300	400	600	600	1,900
	N	8,575	10,960	12,075	12,400	44,010
	C	105	200	370	450	1,125
Total		8,680	11,160	12,445	12,850	45,135
Percentage Change from Previous Quarter						
		26%	29%	12%	3%	
Cumulative Total		28,893	40,053	52,498	65,348	
ASPs: NMOS		\$6.00	\$5.50	\$5.00	\$4.75	\$5.25
CMOS		0	0	0	0	0
Overall		\$6.00	\$5.50	\$5.00	\$4.75	\$5.25
Revenue (\$M)		51.5	60.3	60.4	58.9	231.0
Market Share						
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Year
U.S.		40.3%	39.0%	33.5%	35.0%	36.6%
Japan		59.3	60.0	65.1	63.0	62.1
Europe		0.3	1.0	1.4	1.9	1.3
Total		100.0%	100.0%	100.0%	100.0%	100.0%

S = Sampling
N/A = Not Available

(Continued)

MOS EPROM--Data

Table 3 (Continued)

32K MOS EPROM Shipment Data, 1978-1987

Company	MOS Process	1983				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	800	1,000	1,200	1,500	4,500
Eurotechnique	C	200	300	400	400	1,300
Fujitsu	N	1,200	1,500	1,500	1,500	5,700
	C	10	25	50	50	135
Hitachi	N	3,800	3,500	3,500	3,000	13,800
Intel	N	2,500	2,500	2,200	1,800	9,000
Mitsubishi	N	1,600	1,700	1,500	1,300	6,100
Motorola	N	0	0	0	0	0
National Semi.	C	350	450	600	800	2,200
NEC	N	2,400	2,500	1,700	1,700	8,300
Ricoh	C	N/A	N/A	N/A	S	0
Rockwell	N	N/A	N/A	N/A	N/A	0
	C	N/A	N/A	S	25	25
SGS-Ates	N	50	100	100	100	350
Texas Instruments	N	1,000	2,000	3,000	3,500	9,500
Toshiba	N	600	400	500	500	2,000
	N	13,150	15,200	15,200	14,900	58,450
	C	560	775	1,050	1,275	3,660
Total		13,710	15,975	16,250	16,175	62,110
Percentage Change from Previous Quarter						
		7%	17%	2%	0%	
Cumulative Total		79,058	95,033	111,283	127,458	
ASPs: NMOS		\$4.50	\$4.00	\$3.75	\$3.75	\$3.98
CMOS		0	0	0	0	0
Overall		\$4.50	\$4.00	\$3.75	\$3.75	\$3.98
Revenue (\$M)		59.2	60.8	57.0	55.9	232.9
Market Share						
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Year
U.S.		33.9%	37.2%	43.1%	47.1%	40.6%
Japan		64.3	60.3	53.8	49.8	56.7
Europe		1.8	2.5	3.1	3.1	2.7
Total		100.0%	100.0%	100.0%	100.0%	100.0%

S = Sampling
N/A = Not Available

(Continued)

MOS EPROM--Data

Table 3 (Continued)

32K MOS EPROM Shipment Data, 1978-1987

Company	MOS Process	1984				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	1,600	1,800	2,200	2,200	7,800
Fujitsu	N	1,600	1,800	1,500	1,200	6,100
	C	150	250	250	250	900
Hitachi	N	2,500	2,000	1,500	1,200	7,200
Intel	N	1,800	1,800	2,000	2,000	7,600
Mitsubishi	N	1,100	900	650	400	3,050
Motorola	N	0	0	0	0	0
National Semi.	C	900	1,000	1,100	850	3,850
NEC	N	1,400	1,550	1,000	750	4,700
Ricoh	C	S	S	50	100	150
Rockwell	N	N/A	N/A	S	S	0
	C	50	25	0	0	75
SGS	N	200	350	600	1,000	2,150
Texas Instruments	N	3,800	4,000	3,200	2,200	13,200
Thomson-Eurotechnique	C	350	300	300	250	1,200
Toshiba	N	300	150	50	25	525
	N	14,300	14,350	12,700	10,975	52,325
	C	1,450	1,575	1,700	1,450	6,175
Total		15,750	15,925	14,400	12,425	58,500
Percentage Change from Previous Quarter						
		(3%)	1%	(10%)	(14%)	
Cumulative Total		143,208	159,133	173,533	185,958	
ASPs: NMOS		\$3.60	\$3.50	\$3.25	\$3.10	\$3.38
CMOS		\$7.50	\$7.50	\$7.25	\$7.00	\$7.31
Overall		\$3.96	\$3.90	\$3.72	\$3.56	\$3.80
Revenue (\$M)		62.4	62.0	53.6	44.2	222.2
Market Share						
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Year
U.S.		51.7%	54.2%	59.0%	58.4%	55.6%
Japan		44.8	41.8	34.7	31.6	38.7
Europe		3.5	4.1	6.3	10.1	5.7
Total		100.0%	100.0%	100.0%	100.0%	100.0%

S = Sampling
N/A = Not Available

(Continued)

MOS EPROM--Data

Table 3 (Continued)

32K MOS EPROM Shipment Data, 1978–1987

Company	MOS Process	1985				
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Year
AMD	N	2,200	2,450	1,750	1,300	7,700
Fujitsu	N	800	600	300	250	1,950
	C	250	250	250	150	900
Hitachi	N	900	700	400	400	2,400
Intel	N	1,800	1,500	1,500	1,500	6,300
Mitsubishi	N	650	1,000	450	300	2,400
Motorola	N	0	0	0	0	0
National Semi.	C	700	600	500	500	2,300
NEC	N	730	500	800	530	2,560
Ricoh	C	150	200	200	150	700
Rockwell	N	50	50	0	0	100
	C	0	0	0	0	0
SGS	N	800	700	850	1,000	3,350
Texas Instruments	N	1,800	1,600	1,500	1,200	6,100
Thomson-Eurotechnique	C	350	400	400	400	1,550
Toshiba	N	0	0	0	0	0
	N	9,730	9,100	7,550	6,480	32,860
	C	2,450	1,450	1,350	1,200	5,450
Total		11,180	10,550	8,900	7,680	38,310
Percentage Change from Previous Quarter						
		(10%)	(6%)	(16%)	(14%)	
Cumulative Total		197,138	207,688	216,588	224,268	
ASPs:	NMOS	\$2.80	\$2.25	\$2.20	\$2.20	\$2.39
	CMOS	\$5.50	\$4.50	\$3.50	\$2.80	\$4.14
	Overall	\$3.15	\$2.56	\$2.40	\$2.29	\$2.64
Revenue (\$M)		35.2	27.0	21.3	17.6	101.2
Market Share						
1985						
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Year
U.S.		58.6%	58.8%	59.0%	58.6%	58.7%
Japan		31.1	30.8	27.0	23.2	28.3
Europe		10.3	10.4	14.0	18.2	12.8
Total		100.0%	100.0%	100.0%	100.0%	100.0%

(Continued)

MOS EPROM--Data

Table 3 (Continued)

32K MOS EPROM Shipment Data, 1978-1987

Company	MOS Process	1986				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	950	850	675	450	2,925
Fujitsu	N	150	50	0	0	200
	C	50	0	0	0	50
Hitachi	N	500	200	100	50	850
Intel	N	1,300	1,300	1,000	1,550	5,150
	OTP	250	250	250	100	850
Mitsubishi	N	0	0	282	7	289
National Semi.	C	400	300	300	300	1,300
NEC	N	330	270	150	100	850
Ricoh	C	50	50	0	0	100
SGS	N	463	350	1,200	1,200	3,213
Texas Instruments	N	1,000	1,000	1,100	1,500	4,600
Thomson-Eurotechnique	C	300	300	300	300	1,200
	N	4,943	4,270	4,757	4,957	18,927
	C	800	650	600	600	2,650
Total		5,743	4,920	5,357	5,557	21,577
Percentage Change from Previous Quarter		(25%)	(14%)	9%	4%	
Cumulative Total		230,011	234,931	240,288	245,845	
ASPs:	NMOS	\$2.10	\$2.15	\$2.20	\$2.25	\$2.18
	CMOS	\$2.50	\$2.75	\$2.80	\$2.85	\$2.71
	Overall	\$2.16	\$2.23	\$2.27	\$2.31	\$2.24
Revenue (\$M)		12.4	11.0	12.1	12.9	48.4
		1986				
Market Share		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Year
	U.S.	67.9%	75.2%	62.1%	70.2%	68.7%
	Japan	18.8	11.6	9.9	2.8	10.8
	Europe	13.3	13.2	28.0	27.0	20.5
	Total	100.0%	100.0%	100.0%	100.0%	100.0%

(Continued)

MOS EPROM--Data

Table 3 (Continued)

32K MOS EPROM Shipment Data, 1978-1987

Company	MOS Process	1987				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	425	500	475	575	1,975
Fujitsu	N	0	0	0	0	0
	C	0	0	0	0	0
Hitachi	N	0	0	0	0	0
Intel	N	1,050	1,300	1,100	1,100	4,550
	OTP	0	0	0	0	0
Mitsubishi	N	0	0	0	0	0
National Semi.	C	750	750	744	628	2,872
NEC	N	100	20	20	10	150
Ricoh	C	0	0	0	0	0
SGS-Thomson	N	685	559	471	560	2,275
	C	75	65	50	45	235
Texas Instruments	N	1,500	1,000	1,000	800	4,300
	N	3,760	3,379	3,066	3,045	13,250
	C	825	815	794	673	3,107
Total		4,585	4,194	3,860	3,718	16,357
Percentage Change from Previous Quarter						
		(17%)	(9%)	(8%)	(4%)	
Cumulative Total		250,430	254,624	258,484	262,202	
ASPs:	NMOS	\$2.50	\$2.75	\$2.90	\$3.00	\$2.77
	CMOS	\$2.90	\$3.00	\$3.20	\$3.25	\$3.08
	Overall	\$2.57	\$2.80	\$2.96	\$3.05	\$2.83
Revenue (\$M)		11.8	11.7	11.4	11.3	46.3
Market Share						
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Year
U.S.		81.2%	84.6%	86.0%	83.5%	83.7%
Japan		2.2	0.5	0.5	0.3	0.9
Europe		16.6	14.9	13.5	16.3	15.3
Total		100.0%	100.0%	100.0%	100.0%	100.0%

Note: Columns may not add to totals shown because of rounding.

Source: Dataquest
April 1988

MOS EPROM--Data

Table 4

64K MOS EPROM Shipment Data, 1980-1987

Company	MOS Process	1980				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	N/A	N/A	N/A	N/A	0
Fujitsu	N	N/A	N/A	N/A	N/A	0
	C	N/A	N/A	N/A	N/A	0
Hitachi	N	N/A	N/A	N/A	S	0
	C	N/A	N/A	N/A	N/A	0
Intel	N	N/A	N/A	N/A	S	0
	N	N/A	N/A	N/A	N/A	0
Mitsubishi	N	N/A	N/A	N/A	N/A	0
Mostek	N	N/A	N/A	N/A	S	0
Motorola	N	S	S	S	S	10
NEC	N	N/A	N/A	N/A	N/A	0
	C	N/A	N/A	N/A	N/A	0
Oki Electric	N	N/A	N/A	N/A	N/A	0
Ricoh	C	N/A	N/A	N/A	N/A	0
Rockwell	N	N/A	N/A	N/A	N/A	0
	C	N/A	N/A	N/A	N/A	0
Seeq	N	N/A	N/A	N/A	N/A	0
Seiko-Epson	C	N/A	N/A	N/A	N/A	0
SGS-Ates	N	N/A	N/A	N/A	N/A	0
Sharp	C	N/A	N/A	N/A	N/A	0
Signetics	C	N/A	N/A	N/A	N/A	0
Texas Instruments	N	N/A	S	10	20	30
Toshiba	N	N/A	N/A	N/A	N/A	0
VLSI Technology	C	N/A	N/A	N/A	N/A	0
WaferScale Integ.	N	N/A	N/A	N/A	N/A	0
	N	0	0	15	25	40
	C	0	0	0	0	0
Total		0	0	15	25	40
Percentage Change from Previous Quarter						
		0	0	0	67%	
Cumulative Total						
		0	0	15	40	
ASPs: NMOS						
		0	0	0	0	0
CMOS						
		0	0	0	0	0
Overall						
		\$200.00	\$100.00	\$80.00	\$70.00	\$73.75
Revenue (\$M)						
		0	0	1.2	1.8	3.0
Market Share						
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Year
U.S.						
		0	0	100.0%	100.0%	100.0%
Japan						
		0	0	0	0	0
Europe						
		0	0	0	0	0
Total						
		0	0	100.0%	100.0%	100.0%

S = Sampling
N/A = Not Available

(Continued)

MOS EPROM--Data

Table 4 (Continued)

64K MOS EPROM Shipment Data, 1980-1987

Company	MOS Process	1981				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	N/A	N/A	N/A	N/A	0
Fujitsu	N	S	1	15	100	116
	C	N/A	N/A	N/A	N/A	0
Hitachi	N	S	2	5	25	32
	C	N/A	N/A	N/A	N/A	0
Intel	N	10	70	200	500	780
	N	N/A	N/A	N/A	N/A	0
Mitsubishi	N	N/A	N/A	N/A	S	0
Moatek	N	S	2	5	3	10
Motorola	N	15	40	30	50	135
NEC	N	N/A	N/A	N/A	S	0
	C	N/A	N/A	N/A	N/A	0
Oki Electric	N	N/A	N/A	N/A	N/A	0
Ricoh	C	N/A	N/A	N/A	N/A	0
Rockwell	N	N/A	N/A	N/A	N/A	0
	C	N/A	N/A	N/A	N/A	0
Seeq	N	N/A	N/A	N/A	N/A	0
Seiko-Epson	C	N/A	N/A	N/A	N/A	0
SGS-Ates	N	N/A	N/A	N/A	N/A	0
Sharp	C	N/A	N/A	N/A	N/A	0
Signetix	C	N/A	N/A	N/A	N/A	0
Texas Instruments	N	30	65	100	100	295
Toshiba	N	N/A	N/A	N/A	N/A	0
VLSI Technology	C	N/A	N/A	N/A	N/A	0
WaferScale Integ.	N	N/A	N/A	N/A	N/A	0
	N	55	180	355	778	1,368
	C	0	0	0	0	0
Total		55	180	355	778	1,368
Percentage Change from Previous Quarter						
		120%	227%	97%	119%	
Cumulative Total						
		95	275	630	1,408	
ASPs: NMOS						
		0	0	0	0	0
CMOS						
		0	0	0	0	0
Overall						
		\$70.00	\$60.00	\$38.00	\$24.00	\$34.22
Revenue (\$M)						
		3.9	10.8	13.5	18.7	46.8
Market Share						
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Year
U.S.		100.0%	98.3%	94.4%	83.9%	89.2%
Japan		0	1.7	5.6	16.1	10.8
Europe		0	0	0	0	0
Total		100.0%	100.0%	100.0%	100.0%	100.0%

S = Sampling
N/A = Not Available

(Continued)

MOS EPROM--Data

Table 4 (Continued)

64K MOS EPROM Shipment Data, 1980-1987

Company	MOS Process	1982				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	\$	10	250	500	760
Fujitsu	N	400	1,000	1,500	2,000	4,900
	C	10	25	50	100	185
Hitachi	N	100	250	600	800	1,750
	C	N/A	N/A	N/A	N/A	0
Intel	N	800	1,700	2,500	2,500	7,500
	N	N/A	N/A	N/A	N/A	0
Mitsubishi	N	\$	15	500	1,400	1,915
Mostek	N	0	0	0	0	0
Motorola	N	60	100	100	100	360
NEC	N	\$	10	60	200	270
	C	N/A	N/A	N/A	N/A	0
Oki Electric	N	N/A	N/A	N/A	\$	0
Ricoh	C	N/A	N/A	N/A	N/A	0
Rockwell	N	N/A	N/A	N/A	N/A	0
	C	N/A	N/A	N/A	N/A	0
Seeq	N	N/A	\$	\$	15	20
Seiko-Epson	C	N/A	N/A	N/A	N/A	0
SGS-Ates	N	N/A	N/A	N/A	N/A	0
Sharp	C	N/A	N/A	N/A	N/A	0
Signetics	C	N/A	N/A	N/A	N/A	0
Texas Instruments	N	100	100	100	100	400
Toshiba	N	N/A	\$	20	50	70
VLSI Technology	C	N/A	N/A	N/A	N/A	0
WaferScale Integ.	N	N/A	N/A	N/A	N/A	0
	N	1,460	3,185	5,635	7,665	17,945
	C	10	25	50	100	185
Total		1,470	3,210	5,685	7,765	18,130
Percentage Change from Previous Quarter						
		89%	118%	77%	37%	
Cumulative Total		2,878	6,088	11,773	19,538	
ASPs:						
NMOS		0	0	0	0	0
CMOS		0	0	0	0	0
Overall		\$25.00	\$11.50	\$8.50	\$6.50	\$8.70
Revenue (\$M)		22.1	36.9	48.3	50.5	157.8
Market Share						
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Year
U.S.		65.3%	59.5%	52.0%	41.4%	49.9%
Japan		34.7	40.5	48.0	58.6	50.1
Europe		0	0	0	0	0
Total		100.0%	100.0%	100.0%	100.0%	100.0%

S = Sampling
N/A = Not Available

(Continued)

MOS EPROM--Data

Table 4 (Continued)

64K MOS EPROM Shipment Data, 1980-1987

Company	MOS Process	1983				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	600	900	1,300	1,800	4,600
Fujitsu	N	2,200	2,400	2,500	3,000	10,100
	C	250	300	350	400	1,300
Hitachi	N	1,500	2,300	3,500	5,500	12,800
	C	N/A	S	50	50	100
Intel	N	3,000	3,500	4,000	3,500	14,000
	N	N/A	N/A	N/A	N/A	0
Mitsubishi	N	1,700	2,000	3,200	3,800	10,700
Mostek	N	0	0	0	0	0
Motorola	N	150	200	450	700	1,500
NBC	N	350	500	500	600	1,950
	C	N/A	N/A	N/A	N/A	0
Oki Electric	N	25	50	100	200	375
Ricoh	C	N/A	N/A	N/A	N/A	0
Rockwell	N	N/A	N/A	N/A	N/A	0
	C	N/A	N/A	N/A	N/A	0
Seag	N	25	100	310	600	1,035
Seiko-Epson	C	N/A	N/A	N/A	N/A	0
SGS-Ates	N	N/A	N/A	N/A	S	0
Sharp	C	N/A	N/A	N/A	N/A	0
Signetics	C	N/A	N/A	S	S	0
Texas Instruments	N	400	800	1,500	2,000	4,700
Toshiba	N	200	400	400	600	1,600
VLSI Technology	C	N/A	N/A	N/A	N/A	0
WaferScale Integ.	N	N/A	N/A	N/A	N/A	0
	N	10,150	13,150	17,760	22,300	63,360
	C	250	300	400	450	1,400
Total		10,400	13,450	18,160	22,750	64,760
Percentage Change from Previous Quarter						
		34%	29%	35%	25%	
Cumulative Total						
		29,938	43,388	61,548	84,298	
ASPs: NMOS						
		0	0	0	0	0
CMOS						
		0	0	0	0	0
Overall						
		\$5.50	\$4.75	\$5.00	\$5.50	\$5.20
Revenue (\$M)						
		57.2	63.9	90.8	125.1	337.0
Market Share						
U.S.		40.1%	40.9%	41.6%	37.8%	39.9%
Japan		59.9	59.1	58.4	62.2	60.1
Europe		0	0	0	0	0
Total		100.0%	100.0%	100.0%	100.0%	100.0%

S = Sampling
N/A = Not Available

(Continued)

MOS EPROM--Data

Table 4 (Continued)

64K MOS EPROM Shipment Data, 1980-1987

Company	MOS Process	1984				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	1,200	1,300	1,600	1,700	5,800
Fujitsu	N	2,500	2,800	3,000	3,000	11,300
	C	500	600	700	900	2,700
Hitachi	N	4,000	5,000	6,000	6,000	21,000
	C	100	250	300	350	1,000
Intel	N	2,000	2,000	2,000	2,000	8,000
	N	N/A	N/A	N/A	S	0
Mitsubishi	N	5,000	5,700	5,700	5,000	21,400
Mostek	N	0	0	0	0	0
Motorola	N	900	900	600	500	2,900
NEC	N	800	1,400	900	1,200	4,300
	C	N/A	N/A	N/A	S	0
Oki Electric	N	400	600	500	400	1,900
Ricoh	C	N/A	0	25	100	125
Rockwell	N	8	10	0	0	10
	C	10	50	0	0	60
Seeq	N	800	1,000	1,050	1,100	3,950
Seiko-Epson	C	N/A	N/A	N/A	N/A	0
SGS	N	50	150	350	600	1,150
Sharp	C	N/A	N/A	N/A	N/A	0
Signetics	C	S	10	10	10	30
Texas Instruments	N	2,400	2,600	2,800	2,400	10,200
Toshiba	N	400	1,200	800	500	2,900
VLSI Technology	C	N/A	N/A	N/A	N/A	0
WaferScale Integ.	N	N/A	N/A	N/A	N/A	0
	N	20,450	24,660	25,300	24,400	94,810
	C	610	910	1,035	1,360	3,915
Total		21,060	25,570	26,335	25,760	98,725
Percentage Change from Previous Quarter		(7%)	21%	3%	(2%)	
Cumulative Total		105,358	130,928	157,263	183,023	
ASPs: NMOS		\$5.25	\$5.25	\$4.75	\$4.25	\$4.86
CMOS		\$15.00	\$15.00	\$13.50	\$10.00	\$12.87
Overall		\$5.53	\$5.60	\$5.09	\$4.55	\$5.18
Revenue (\$M)		116.5	143.1	134.1	117.3	511.1
		1984				
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Year
Market Share						
U.S.		34.7%	30.8%	30.6%	29.9%	31.3%
Japan		65.1	68.6	68.1	67.7	67.5
Europe		0.2	0.6	1.3	2.3	1.2
Total		100.0%	100.0%	100.0%	100.0%	100.0%

S = Sampling
N/A = Not Available

(Continued)

MOS EPROM--Data

Table 4 (Continued)

64K MOS EPROM Shipment Data, 1980-1987

Company	MOS Process	1985				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	2,100	1,550	1,825	1,150	6,625
Fujitsu	N	3,500	3,500	3,800	3,500	14,300
	C	800	950	1,000	1,200	3,950
Hitachi	N	5,500	5,200	5,000	4,500	20,200
	C	400	400	450	500	1,750
Intel	N	2,600	3,000	3,000	2,900	11,500
	N	25	75	150	250	500
Mitsubishi	N	4,850	2,600	4,300	4,200	15,950
Mostek	N	0	0	0	0	0
Motorola	N	400	300	300	400	1,400
NEC	N	1,250	1,450	1,650	1,800	6,150
	C	40	200	350	300	890
Oki Electric	N	350	300	200	150	1,000
Ricoh	C	200	250	250	150	850
Rockwell	N	0	0	0	0	0
	C	0	0	0	0	0
Seeq	N	625	500	350	275	1,750
Seiko-Epson	C	N/A	N/A	N/A	S	0
SGS	N	880	850	1,000	1,350	4,080
Sharp	C	N/A	N/A	N/A	S	0
Signetics	C	0	0	0	0	0
Texas Instruments	N	2,200	2,000	2,000	2,000	8,200
Toshiba	N	800	600	500	350	2,250
VLSI Technology	C	N/A	S	20	40	60
WaferScale Integ.	N	N/A	N/A	S	10	10
	N	25,080	21,925	24,075	22,825	93,905
	C	1,440	1,800	2,070	2,200	7,510
Total		26,520	23,725	26,145	25,025	101,415
Percentage Change from Previous Quarter						
		3%	(11%)	10%	(4%)	
Cumulative Total		209,543	233,268	259,413	284,438	
ASPs:	NMOS	\$3.60	\$2.80	\$2.35	\$2.10	\$2.73
	CMOS	\$6.00	\$4.55	\$3.75	\$3.25	\$4.23
	Overall	\$3.63	\$2.93	\$2.46	\$2.20	\$2.84
Revenue (\$M)		98.9	69.6	64.3	55.1	287.9
Market Share						
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Year
U.S.		30.0%	31.3%	29.2%	28.1%	29.6%
Japan		66.7	65.1	66.9	66.5	66.4
Europe		3.3	3.6	3.8	5.4	4.0
Total		100.0%	100.0%	100.0%	100.0%	100.0%

S = Sampling
N/A = Not Available

(Continued)

MOS EPROM--Data

Table 4 (Continued)

64K MOS EPROM Shipment Data, 1980-1987

Company	MOS Process	1986				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	850	800	900	1,385	3,935
Fujitsu	N	1,500	1,500	2,000	4,000	9,000
	C	1,000	1,000	2,000	4,000	8,000
General Instruments	C	S	0	31	170	201
	OTP	N/A	N/A	S	10	10
Goldstar	C	S	S	0	5	5
Hitachi	N	5,400	5,000	4,500	4,000	18,900
	C	700	700	700	700	2,800
Hyundai	C	S	S	0	5	5
Intel	N	3,400	3,300	2,400	3,200	12,300
	C	250	500	425	400	1,575
	N OTP	400	400	300	200	1,300
	C OTP	0	30	130	100	260
Mitsubishi	N	3,226	3,339	3,459	2,810	12,834
	OTP	775	43	564	511	1,893
Motorola	N	147	346	177	114	784
	OTP	66	87	54	22	229
National Semi.	C	25	75	150	200	450
NEC	N	1,850	1,000	300	150	3,300
	C	800	1,000	490	300	2,590
	OTP	240	140	100	50	530
Ricoh	C	0	0	25	50	75
Seeq	N	525	615	315	150	1,605
Seiko-Epson	C	0	75	100	150	325
SGS	N	552	608	2,500	2,500	6,160
Sharp	C	0	5	10	15	30
	OTP	S	S	0	0	0
Signetics	C	0	5	5	10	20
Texas Instruments	N	1,400	1,400	1,800	1,600	6,200
Toshiba	N	500	600	600	900	2,600
	OTP	100	400	500	500	1,500
VLSI Technology	C	40	40	40	50	170
WaferScale Integ.	C	0	10	10	10	30
Others	C	0	0	5	5	10
	N	20,691	19,438	20,369	22,042	82,540
	C	3,055	3,580	4,221	6,230	17,086
Total		23,746	23,018	24,590	28,272	99,626
Percentage Change from Previous Quarter						
		(5%)	(3%)	7%	15%	
Cumulative Total		308,184	331,202	355,792	384,064	
ASPs:	NMOS	\$2.15	\$2.35	\$2.60	\$2.75	\$2.47
	CMOS	\$3.50	\$3.75	\$3.85	\$4.10	\$3.86
	Overall	\$2.32	\$2.57	\$2.81	\$3.05	\$2.71
Revenue (\$M)		55.2	59.1	69.2	86.2	269.7
1986						
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Year
Market Share						
U.S.		29.9%	33.1%	27.4%	27.0%	29.2%
Japan		67.8	64.3	62.4	64.1	64.6
Europe		2.3	2.6	10.2	8.8	6.2
ROW		0	0	0	0	0
Total		100.0%	100.0%	100.0%	100.0%	100.0%

S = Sampling
N/A = Not Available

(Continued)

MOS EPROM--Data

Table 4 (Continued)

64K MOS EPROM Shipment Data, 1980-1987

Company	MOS Process	1987				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	1,300	1,500	1,150	1,750	5,700
Cypress	C	50	75	100	100	325
Fujitsu	N	400	500	800	800	2,500
	C	1,600	2,000	2,200	2,200	8,200
Goldstar	C	5	5	5	5	20
Hitachi	N	2,500	1,500	1,000	0	5,000
	C	700	700	400	0	1,800
	C OTP	0	50	100	0	150
Hyundai	C	5	5	10	20	40
Intel	N	1,400	1,400	1,100	1,700	5,600
	C	400	400	500	400	1,700
	N OTP	350	300	150	250	1,050
	C OTP	200	250	200	200	850
Microchip Tech., Inc.	C	100	200	350	500	1,150
	OTP	10	20	50	100	180
Mitsubishi	N	1,450	1,150	1,250	1,700	5,550
	OTP	450	250	200	350	1,250
Motorola	N	125	100	86	60	371
	OTP	17	10	13	6	46
National Semi.	C	606	1,198	1,580	2,341	5,725
	C OTP	N/A	N/A	N/A	8	0
NEC	N	400	60	70	0	530
	C	1,000	370	390	200	1,960
	OTP	0	0	0	0	0
Oki Electric	N	50	50	50	50	200
	N OTP	450	450	400	350	1,650
Ricoh	C	50	50	100	100	300
Seeq	N	200	200	200	200	800
Seiko-Epson	C	100	100	100	100	400
SGS-Thomson	N	872	1,643	2,081	2,100	6,696
	C	80	110	40	100	330
	C OTP	5	45	70	100	220
Sharp	C	0	80	150	250	480
	OTP	0	0	0	0	0
Signetics	C	200	200	250	250	900
Texas Instruments	N	1,100	1,200	1,350	1,400	5,050
Toshiba	N	700	500	500	200	1,900
	N OTP	1,000	1,000	1,000	1,000	4,000
VLSI Technology	C	75	100	100	100	375
WaferScale Integ.	C	30	50	50	50	180
	N	12,764	11,813	11,400	11,916	47,893
	C	5,416	6,008	6,745	7,116	25,285
Total		18,180	17,821	18,145	19,032	73,178

(Continued)

MOS EPROM--Data

Table 4 (Continued)

64K MOS EPROM Shipment Data, 1980-1987

Percentage Change from Previous Quarter		(36%)	(2%)	2%	5%	
Cumulative Total		402,244	420,065	438,210	457,242	
ASPs:	NMOS	\$2.80	\$2.90	\$3.00	\$3.10	\$2.95
	CMOS	\$3.00	\$3.10	\$3.00	\$3.20	\$3.08
	Overall	\$2.86	\$2.97	\$3.00	\$3.14	\$2.99
Revenue (\$M)		52.0	52.9	54.4	59.7	219.0

	1987				
	1st	2nd	3rd	4th	
	<u>Qtr.</u>	<u>Qtr.</u>	<u>Qtr.</u>	<u>Qtr.</u>	<u>Year</u>
Market Share					
U.S.	33.9%	40.4%	39.8%	49.4%	41.0%
Japan	60.8	49.4	48.0	38.4	49.0
Europe	5.3	10.1	12.1	12.1	9.9
ROW	0.1	0.1	0.1	0.1	0.1
Total	100.0%	100.0%	100.0%	100.0%	100.0%

S = Sampling

N/A = Not Available

Note: Columns may not add to totals shown because of rounding.

Source: Dataquest
April 1988

MOS EPROM--Data

Table 5

128K MOS EPROM Shipment Data, 1982-1987

Company	MOS Process	1982				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	N/A	N/A	N/A	S	0
Fujitsu	N	N/A	N/A	N/A	S	0
	C	N/A	N/A	N/A	N/A	0
Hitachi	N	N/A	N/A	N/A	S	0
Intel	N	3	15	50	150	218
Mitsubishi	N	N/A	N/A	N/A	N/A	0
	C	N/A	N/A	N/A	N/A	0
NEC	N	N/A	N/A	N/A	N/A	0
Seeq	N	N/A	N/A	N/A	S	0
Texas Instruments	N	N/A	S	5	5	10
	C	N/A	N/A	N/A	N/A	0
Toshiba	N	N/A	N/A	N/A	N/A	N/A
	N	3	15	55	155	228
	C	0	0	0	0	0
Total		3	15	55	155	228
Percentage Change from Previous Quarter						
		0	400%	267%	182%	
Cumulative Total						
		3	18	73	228	
Average Selling Price						
		\$75.00	\$60.00	\$50.00	\$40.00	\$44.19
Revenue (\$M)						
		0.2	0.9	2.8	6.2	10.1
Market Share						
		100.0%	100.0%	100.0%	100.0%	100.0%
U.S.		0	0	0	0	0
Japan		0	0	0	0	0
Europe		0	0	0	0	0
Total		100.0%	100.0%	100.0%	100.0%	100.0%

S = Sampling
N/A = Not Available

(Continued)

MOS EPROM—Data

Table 5 (Continued)

128K MOS EPROM Shipment Data, 1982-1987

Company	MOS Process	1983				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	50	175	300	500	1,025
Fujitsu	N	10	50	150	350	560
	C	S	10	25	35	70
Hitachi	N	10	50	150	350	560
Intel	N	450	800	1,200	1,500	3,950
Mitsubishi	N	S	10	10	10	30
	C	N/A	N/A	N/A	N/A	0
NEC	N	S	10	20	100	130
Seeq	N	N/A	S	50	100	150
Texas Instruments	N	0	0	0	0	0
	C	N/A	N/A	N/A	N/A	0
Toshiba	N	S	10	20	50	80
	N	520	1,105	1,900	2,960	6,485
	C	0	10	25	35	70
Total		520	1,115	1,925	2,995	6,555
Percentage Change from Previous Quarter						
		235%	114%	73%	56%	
Cumulative Total						
		748	1,863	3,788	6,783	
Average Selling Price						
		\$30.00	\$22.00	\$17.00	\$16.00	\$18.44
Revenue (\$M)						
		15.6	24.5	32.7	47.9	120.8
Market Share						
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Year
U.S.		96.2%	87.4%	80.5%	70.1%	78.2%
Japan		3.8	12.6	19.5	29.9	21.8
Europe		0	0	0	0	0
Total		100.0%	100.0%	100.0%	100.0%	100.0%

S = Sampling
N/A = Not Available

(Continued)

MOS EPROM--Data

Table 5 (Continued)

128K MOS EPROM Shipment Data, 1982-1987

Company	MOS Process	1984				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	500	800	850	900	3,050
Fujitsu	N	550	750	800	700	2,800
	C	50	75	100	100	325
Hitachi	N	650	1,800	2,000	2,800	7,250
Intel	N	1,500	1,600	1,700	2,200	7,000
Mitsubishi	N	60	400	1,500	2,200	4,160
	C	N/A	N/A	N/A	S	0
NEC	N	20	160	600	1,000	1,780
Seeq	N	150	400	525	575	1,650
Texas Instruments	N	10	25	25	25	85
	C	N/A	N/A	N/A	N/A	0
Toshiba	N	100	300	500	900	1,800
	N	3,540	6,235	8,500	11,300	29,575
	C	50	75	100	100	325
Total		3,590	6,310	8,600	11,400	29,900
Percentage Change from Previous Quarter						
		20%	76%	36%	33%	
Cumulative Total		10,373	16,683	25,283	36,683	
ASPs:	NMOS	\$15.25	\$14.00	\$12.25	\$10.00	\$12.12
	CMOS	\$28.00	\$23.00	\$20.00	\$18.00	\$21.77
	Overall	\$15.43	\$14.13	\$12.34	\$10.07	\$12.22
Revenue (\$M)		55.4	89.2	106.1	114.8	365.5
Market Share						
		1984				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
U.S.		60.2%	44.8%	36.0%	32.5%	39.4%
Japan		39.8	55.2	64.0	67.5	60.6
Europe		0	0	0	0	0
Total		100.0%	100.0%	100.0%	100.0%	100.0%

S = Sampling
N/A = Not Available

(Continued)

MOS EPROM--Data

Table 5 (Continued)

128K MOS EPROM Shipment Data, 1982-1987

Company	MOS Process	1985				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	1,150	950	850	900	3,850
Fujitsu	N	1,000	1,500	1,750	2,000	6,250
	C	100	100	100	100	400
Hitachi	N	3,000	3,200	3,500	3,100	12,800
Intel	N	2,000	1,800	2,000	2,200	8,000
Mitsubishi	N	1,800	2,000	2,700	3,000	9,500
	C	5	10	10	100	125
NEC	N	1,500	2,000	1,750	3,200	8,450
Seeg	N	375	300	250	225	1,150
Texas Instruments	N	50	25	0	0	75
	C	N/A	N/A	S	25	25
Toshiba	N	1,000	1,200	1,500	1,500	5,200
	N	11,875	12,975	14,300	16,125	55,275
	C	105	110	110	225	550
Total		11,980	13,085	14,410	16,350	55,825
Percentage Change from Previous Quarter		5%	9%	10%	13%	
Cumulative Total		48,663	61,748	76,158	92,508	
ASPs: NMOS		\$6.50	\$4.10	\$3.10	\$2.60	\$3.92
CMOS		\$15.00	\$9.00	\$5.00	\$3.75	\$7.20
Overall		\$6.57	\$4.14	\$3.11	\$2.62	\$3.95
Revenue (\$M)		78.8	54.2	44.9	42.8	220.6
Market Share		1985				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
U.S.		29.8%	23.5%	21.5%	20.5%	23.5%
Japan		70.2	76.5	78.5	79.5	76.5
Europe		0	0	0	0	0
Total		100.0%	100.0%	100.0%	100.0%	100.0%

S = Sampling
N/A = Not Available

(Continued)

MOS EPROM--Data

Table 5 (Continued)

128K MOS EPROM Shipment Data, 1982-1987

Company	MOS Process	1986				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	1,300	1,100	1,050	1,715	5,165
Fujitsu	N	800	800	800	800	3,200
	C	100	100	100	100	400
General Instrument	C	N/A	S	20	150	170
	OTP	N/A	N/A	S	10	10
Hitachi	N	3,200	3,000	2,500	2,500	11,200
Intel	N	2,200	2,600	2,800	2,900	10,500
	OTP	200	500	650	400	1,750
Mitsubishi	N	2,300	1,850	1,800	1,700	7,650
	C	75	70	90	120	355
	N OTP	650	650	550	300	2,150
	C OTP	0	0	0	0	0
NBC	N	3,110	3,000	1,520	1,000	8,630
Seeq	N	325	325	300	225	1,175
Seiko-Epson	N	0	10	15	25	50
Texas Instruments	N	N/A	N/A	N/A	N/A	0
	C	100	175	225	400	900
Toshiba	N	700	700	700	600	2,700
	OTP	50	200	400	600	1,250
VLSI Technology	C	5	10	10	10	35
WaferScale Integ.	C	S	0	5	5	10
Others	C	N/A	S	5	10	15
	N	14,835	14,735	13,085	12,780	55,435
	C	280	355	455	805	1,895
Total		15,115	15,090	13,540	13,585	57,330
Percentage Change from Previous Quarter						
		(8%)	0	(10%)	0	
Cumulative Total		107,623	122,713	136,253	149,123	
ASPs:						
	NMOS	\$2.55	\$2.65	\$2.75	\$2.75	\$ 2.67
	CMOS	\$3.70	\$3.90	\$4.00	\$4.00	\$ 3.94
	Overall	\$2.57	\$2.68	\$2.79	\$2.82	\$ 2.71
Revenue (\$M)		38.9	40.4	37.8	38.4	155.5
Market Share						
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Year
U.S.		27.3%	31.2%	37.4%	42.9%	34.4%
Japan		72.7	68.8	62.6	57.0	65.6
Europe		0.0	0.0	0.0	0.1	0.0
Total		100.0%	100.0%	100.0%	100.0%	100.0%

S = Sampling
N/A = Not Applicable

(Continued)

MOS EPROM--Data

Table 5 (Continued)

128K MOS EPROM Shipment Data, 1982-1987

Company	MOS Process	1987				
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Year
AMD	N	1,300	1,925	1,725	1,875	6,825
Fujitsu	N	1,000	1,200	1,100	1,100	4,400
	C	600	800	900	900	3,200
Hitachi	N	2,000	2,000	1,800	0	5,800
Intel	N	2,200	2,250	1,000	2,250	7,700
	N OTP	800	600	420	140	1,960
	C	0	100	250	300	650
	C OTP	0	0	20	20	40
Microchip Tech., Inc.	C	200	250	420	400	1,270
	C OTP	20	45	80	200	345
Mitsubishi	N	1,150	1,300	1,400	950	4,800
	C	40	100	130	60	330
	N OTP	120	250	300	100	770
	C OTP	0	0	0	0	0
National Semi.	C	222	191	223	390	1,026
NEC	N	900	590	430	330	2,250
Oki Electric	N	100	150	100	100	450
	N OTP	400	450	400	350	1,600
Seeq	N	150	150	100	100	500
Seiko-Epson	N	0	10	15	25	50
SGS-Thomson	N	178	525	1,157	1,700	3,560
Texas Instruments	N	0	25	25	70	120
	C	800	900	1,000	1,200	3,900
Toshiba	N	500	500	600	600	2,200
	N OTP	900	1,000	1,000	1,000	3,900
VLSI Technology	C	5	10	10	10	35
WaferScale Integ.	C	5	0	5	5	10
	N	11,698	12,925	11,572	10,690	46,885
	C	1,887	2,396	3,038	3,485	10,806
Total		13,585	15,321	14,610	14,175	57,691
Percentage Change from Previous Quarter		6%	13%	(5%)	(3%)	
Cumulative Total		162,708	178,029	192,639	206,814	
ASPs:	NMOS	\$3.00	\$3.35	\$3.45	\$3.75	\$ 3.38
	CMOS	\$3.90	\$3.80	\$3.90	\$4.25	\$ 3.99
	Overall	\$3.13	\$3.42	\$3.54	\$3.87	\$ 3.49
Revenue (\$M)		42.5	52.4	51.8	54.9	201.5
		1987				
Market Share		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Year
		41.9%	42.1%	36.1%	49.1%	42.3%
U.S.		56.8	54.5	56.0	38.9	51.6
Japan		1.3	3.4	7.9	12.0	6.2
Europe						
Total		100.0%	100.0%	100.0%	100.0%	100.0%

\$ = Sampling

N/A = Not Applicable

Note: Columns may not add to totals shown because of rounding.

Source: Dataquest
April 1988

MOS EPROM--Data

Table 6

256K MOS EPROM Shipment Data, 1983-1987

Company	MOS Process	1983				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	N/A	S	10	25	35
Atmel	N	N/A	N/A	N/A	N/A	0
	C	N/A	N/A	N/A	N/A	0
Fujitsu	N	N/A	N/A	N/A	N/A	0
	C	S	S	5	20	25
General Instrument	N	N/A	N/A	N/A	N/A	0
	C	N/A	N/A	N/A	N/A	0
Hitachi	N	N/A	N/A	N/A	N/A	0
	C	N/A	N/A	N/A	N/A	0
Intel	N	5	10	35	90	140
	C	N/A	N/A	N/A	N/A	0
Mitsubishi	N	N/A	N/A	N/A	S	0
National Semi.	C	N/A	N/A	N/A	N/A	0
NEC	N	N/A	N/A	N/A	S	0
	C	N/A	N/A	N/A	N/A	0
Seeq	C	N/A	N/A	N/A	N/A	0
Seiko-Epson	C	N/A	N/A	N/A	N/A	0
SGS-Ates	N	N/A	N/A	N/A	N/A	0
Texas Instruments	C	N/A	N/A	N/A	N/A	0
Toshiba	N	N/A	N/A	N/A	N/A	0
	C	N/A	N/A	N/A	N/A	0
VLSI Technology	C	N/A	N/A	N/A	N/A	0
WaferScale Integ.	C	N/A	N/A	N/A	N/A	0
	N	5	10	45	115	175
	C	0	0	5	20	25
Total		5	10	50	135	200
Percentage Change from Previous Quarter						
		0	100%	400%	170%	
Cumulative Total						
		5	15	65	200	
ASPs: NMOS						
		\$150	\$125	\$100	\$95	\$100
CMOS						
		0	0	\$145	\$115	\$121
Overall						
		\$150	\$125	\$105	\$98	\$102
Revenue (\$M)						
		0.8	1.3	5.2	13.2	20.5
Market Share						
		100.0%	100.0%	100.0%	100.0%	100.0%
U.S.						
		0	0	0	0	0
Japan						
		0	0	0	0	0
Europe						
		0	0	0	0	0
Total		100.0%	100.0%	100.0%	100.0%	100.0%

S = Sampling
N/A = Not Available

(Continued)

MOS EPROM--Data

Table 6 (Continued)

256K MOS EPROM Shipment Data, 1983-1987

Company	MOS Process	1984				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	100	130	100	250	580
Atmel	N	N/A	N/A	N/A	N/A	0
	C	N/A	N/A	N/A	N/A	0
Fujitsu	N	N/A	N/A	N/A	10	10
	C	30	40	50	75	195
General Instrument	N	N/A	N/A	N/A	N/A	0
	C	N/A	N/A	N/A	N/A	0
Hitachi	N	N/A	N/A	S	S	0
	C	N/A	N/A	S	S	0
Intel	N	150	250	375	475	1,250
	C	N/A	N/A	N/A	N/A	0
Mitsubishi	N	S	S	S	S	5
National Semi.	C	N/A	N/A	N/A	N/A	0
NEC	N	S	S	S	S	5
	C	N/A	N/A	N/A	N/A	0
Seeq	C	N/A	S	S	S	5
Seiko-Epson	C	N/A	N/A	N/A	N/A	0
SGS	N	N/A	N/A	N/A	N/A	0
Texas Instruments	C	N/A	N/A	N/A	N/A	0
Toshiba	N	10	30	50	100	190
	C	N/A	N/A	S	S	0
VLSI Technology	C	N/A	N/A	N/A	N/A	0
WaferScale Integ.	C	N/A	—	—	—	0
	N	260	410	525	845	2,040
	C	30	40	50	80	200
Total		290	450	575	925	2,240
Percentage Change from Previous Quarter						
		115%	55%	28%	61%	
Cumulative Total						
		490	940	1,515	2,440	
ASPs: NMOS						
		\$75.00	\$45.00	\$35.00	\$28.00	\$39.21
CMOS						
		\$100.00	\$80.00	\$60.00	\$45.00	\$64.00
Overall						
		\$77.59	\$48.11	\$37.17	\$29.47	\$41.42
Revenue (\$M)						
		22.5	21.7	21.4	27.3	92.8
Market Share						
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Year
U.S.		86.2%	84.4%	82.6%	78.9%	81.9%
Japan		13.8	15.6	17.4	21.1	18.1
Europe		0	0	0	0	0
Total		100.0%	100.0%	100.0%	100.0%	100.0%

S = Sampling
N/A = Not Available

(Continued)

MOS EPROM--Data

Table 6 (Continued)

256K MOS EPROM Shipment Data, 1983-1987

Company	MOS Process	1985				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	450	800	950	950	3,150
Atmel	N	N/A	N/A	N/A	S	0
	C	N/A	N/A	N/A	S	0
Fujitsu	N	25	200	400	650	1,275
	C	150	250	400	600	1,400
General Instrument	N	N/A	N/A	S	25	25
	C	N/A	N/A	S	10	10
Hitachi	N	50	200	500	800	1,550
	C	S	25	150	300	475
Intel	N	1,000	1,800	2,400	2,700	7,900
	C	N/A	S	50	100	150
Mitsubishi	N	5	25	70	600	700
National Semi.	C	S	S	S	10	10
NEC	N	30	230	550	750	1,560
	C	S	50	150	200	400
Seeq	C	15	110	180	250	555
Seiko-Epson	C	N/A	N/A	N/A	S	0
SGS	N	N/A	N/A	S	10	10
Texas Instruments	C	N/A	N/A	S	50	50
Toshiba	N	150	350	550	700	1,750
	C	150	200	300	425	1,075
VLSI Technology	C	N/A	S	25	50	75
WaferScale Integ.	C	N/A	N/A	S	S	0
	N	1,710	3,605	5,420	7,185	17,920
	C	315	635	1,255	1,995	4,200
Total		2,025	4,240	6,675	9,180	22,120
Percentage Change from Previous Quarter		350%	109%	57%	38%	
Cumulative Total		4,465	8,705	15,380	24,560	
ASPs:						
NMOS		\$20.00	\$12.00	\$5.30	\$4.25	\$7.63
CMOS		\$30.00	\$13.50	\$7.00	\$6.00	\$9.23
Overall		\$21.56	\$12.22	\$5.62	\$4.63	\$7.93
Revenue (\$M)		43.7	51.8	37.5	42.5	175.5
		1985				
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Year
Market Share						
U.S.		72.3%	63.9%	54.0%	45.2%	53.9%
Japan		27.7	36.1	46.0	54.7	46.0
Europe		0	0	0	0.1	0
Total		100.0%	100.0%	100.0%	100.0%	100.0%

S = Sampling
N/A = Not Available

(Continued)

MOS EPROM--Data

Table 6 (Continued)

256K MOS EPROM Shipment Data, 1983-1987

Company	MOS Process	1986				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	700	1,000	1,050	1,000	3,750
Atmel	N	0	0	0	0	0
	C	0	0	0	0	0
Fujitsu	N	500	500	500	600	2,100
	C	200	250	250	400	1,100
General Instrument	N	908	600	545	500	2,553
	C	112	317	493	500	1,422
	C OTP	35	85	10	200	330
Hitachi	N	950	1,100	1,350	1,500	4,900
	C	350	500	650	800	2,300
	C OTP	0	0	0	0	0
Intel	N	3,300	4,000	4,200	4,000	15,500
	C	150	175	450	550	1,325
	N OTP	200	250	280	300	1,030
Mitsubishi	N	1,637	2,096	1,776	935	6,444
	C	0	0	19	157	176
	N OTP	1,249	1,480	1,435	3,435	7,599
	C OTP	0	0	0	0	0
National Semi.	C	25	100	250	300	675
NEC	N	1,230	1,250	990	500	3,970
	C	1,620	1,220	1,140	800	4,780
Oki Electric	N	N/A	S	0	30	30
Ricoh	C	0	0	5	5	10
Seeq	C	70	70	40	40	220
Seiko-Epson	C	0	5	10	10	25
SGS	N	6	136	10	10	162
Signetics	C	S	S	5	15	20
Texas Instrument	C	125	200	225	800	1,350
Toshiba	N	600	800	800	800	3,000
	C	300	400	400	400	1,500
	N OTP	300	500	800	1,200	2,800
	C OTP	100	200	200	200	700
VLSI Technology	C	50	50	50	50	200
WaferScale Integ.	C	S	5	5	5	15
Others	N	0	0	0	0	0
	C	5	5	5	5	20
	N	11,580	13,712	13,736	14,810	53,838
	C	3,142	3,582	4,207	5,237	16,168
Total		14,722	17,294	17,943	20,047	70,006

(Continued)

MOS EPROM--Data

Table 6 (Continued)

256K MOS EPROM Shipment Data, 1983-1987

	1986				Year
	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
Percentage Change from Previous Quarter	60%	17%	4%	12%	
Cumulative Total	39,282	56,576	74,519	94,566	
ASPs: NMOS	\$4.14	\$4.50	\$4.50	\$4.20	\$4.34
CMOS	\$5.00	\$5.50	\$5.50	\$5.25	\$5.32
Overall	\$4.32	\$4.71	\$4.73	\$4.47	\$4.57
Revenue (\$M)	63.7	81.4	85.0	89.7	319.7

	1986				Year
	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
Market Share					
U.S.	38.6%	39.6%	42.4%	41.2%	40.6%
Japan	61.4	59.6	57.5	58.7	59.2
Europe	0.0	0.8	0.1	0.0	0.2
Total	100.0%	100.0%	100.0%	100.0%	100.0%

S = Sampling

N/A = Not Available

Columns may not add to totals shown because of rounding.

(Continued)

MOS EPROM--Data

Table 6 (Continued)
256K MOS EPROM Shipment Data, 1983-1987

<u>Company</u>	<u>MOS Process</u>	<u>1987</u>				<u>Year</u>
		<u>1st Qtr.</u>	<u>2nd Qtr.</u>	<u>3rd Qtr.</u>	<u>4th Qtr.</u>	
AMD	N	1,585	1,850	1,600	2,175	7,210
	C	0	10	100	400	510
Fujitsu	N	900	800	950	900	3,550
	C	700	1,700	2,050	2,500	6,950
Hitachi	N	2,500	2,500	1,500	0	6,500
	C	2,200	2,000	2,000	0	6,200
	C OTP	0	0	0	0	0
Intel	N	4,500	5,400	4,300	4,600	18,800
	C	450	500	370	260	1,580
	N OTP	800	1,200	1,000	950	3,950
	C OTP	100	50	250	170	570
Microchip Tech., Inc.	N	600	700	700	800	2,800
	C	900	1,000	1,000	300	3,200
	OTP	200	200	400	100	900
Mitsubishi	N	1,300	1,800	2,200	1,750	7,050
	C	400	500	750	1,050	2,700
	N OTP	950	450	800	550	2,750
	C OTP	0	0	50	130	180
National Semi.	C	654	1,257	1,606	3,510	7,027
NEC	N	690	540	360	400	1,990
	C	1,090	870	1,600	1,250	4,810
Oki Electric	N	100	100	100	50	350
	N OTP	800	800	800	800	3,200
Ricoh	C	5	5	10	20	40
Seeq	C	75	75	75	75	300
Seiko-Epson	C	20	20	20	10	70
SGS-Thomson	N	836	1,162	1,170	1,600	4,768
Signetics	C	200	250	300	300	1,050
Texas Instrument	C	1,500	1,500	1,800	2,000	6,800
Toshiba	N	800	800	1,000	1,500	4,100
	C	500	800	1,200	1,000	3,500
	N OTP	1,400	1,500	1,000	1,000	4,900
	C OTP	200	400	400	400	1,400
VLSI Technology	C	25	30	30	50	135
WaferScale Integ.	C	15	20	20	30	85
	N	17,761	19,602	17,480	17,075	71,918
	C	9,234	11,187	14,031	13,555	48,007
Total		26,995	30,789	31,511	30,630	119,925

(Continued)

MOS EPROM--Data

Table 6 (Continued)

256K MOS EPROM Shipment Data, 1983-1987

	1987				
	1st	2nd	3rd	4th	
	<u>Qtr.</u>	<u>Qtr.</u>	<u>Qtr.</u>	<u>Qtr.</u>	<u>Year</u>
Percentage Change from Previous Quarter	35%	14%	2%	(3%)	
Cumulative Total	121,561	152,350	183,861	214,491	
ASPs: NMOS	\$4.25	\$4.35	\$4.40	\$4.45	\$4.36
CMOS	\$4.90	\$5.00	\$5.10	\$5.10	\$5.04
Overall	\$4.47	\$4.59	\$4.71	\$4.74	\$4.63
Revenue (\$M)	120.7	141.2	148.5	145.1	555.5

	1987				
	1st	2nd	3rd	4th	
	<u>Qtr.</u>	<u>Qtr.</u>	<u>Qtr.</u>	<u>Qtr.</u>	<u>Year</u>
Market Share					
U.S.	43.0%	45.6%	43.0%	51.3%	45.8%
Japan	53.9	50.6	53.3	43.5	50.2
Europe	<u>3.1</u>	<u>3.8</u>	<u>3.7</u>	<u>5.2</u>	<u>4.0</u>
Total	100.0%	100.0%	100.0%	100.0%	100.0%

S = Sampling

N/A = Not Available

Columns may not add to totals shown because of rounding.

Source: Dataquest
April 1988

MOS EPROM--Data

Table 7

512K MOS EPROM Shipment Data, 1984-1987

Company	MOS Process	1984				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	S	2	2	4	8
Fujitsu	N	N/A	N/A	N/A	N/A	0
General Instrument	C	N/A	N/A	N/A	N/A	0
Hitachi	N	N/A	N/A	N/A	N/A	0
	C	N/A	N/A	N/A	N/A	0
Intel	N	N/A	S	2	6	8
Mitsubishi	N	N/A	N/A	N/A	N/A	0
Toshiba	N	N/A	N/A	N/A	N/A	0
	C	N/A	N/A	N/A	N/A	0
VLSI Technology	C	N/A	N/A	N/A	N/A	0
WaferScale Integ.	C	N/A	N/A	N/A	N/A	0
	N	0	2	4	10	16
	C	0	0	0	0	0
Total		0	2	4	10	16
Percentage Change from Previous Quarter						
		0	0	100%	150%	
Cumulative Total						
		0	2	6	16	
ASPs: NMOS		\$250.00	\$150.00	\$120.30	\$95.00	\$108.13
CMOS		0	0	0	0	0
Overall		\$250.00	\$150.00	\$120.40	\$95.00	\$108.13
Revenue (\$M)						
		0	0.3	0.5	1.0	1.7
Market Share						
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Year
U.S.		0	100.0%	100.0%	100.0%	100.0%
Japan		0	0	0	0	0
Europe		0	0	0	0	0
Total		0	100.0%	100.0%	100.0%	100.0%

S = Sampling
N/A = Not Available

(Continued)

MOS EPROM--Data

Table 7 (Continued)

512K MOS EPROM Shipment Data, 1984-1987

Company	MOS Process	1985				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	12	30	35	75	152
Fujitsu	N	N/A	N/A	S	10	10
General Instrument	C	N/A	N/A	N/A	N/A	0
Hitachi	N	N/A	N/A	S	15	15
	C	N/A	N/A	N/A	N/A	0
Intel	N	15	50	65	135	265
Mitsubishi	N	N/A	N/A	N/A	N/A	0
Toshiba	N	N/A	N/A	N/A	S	0
	C	N/A	N/A	N/A	N/A	0
VLSI Technology	C	N/A	N/A	N/A	N/A	0
WaferScale Integ.	C	N/A	N/A	N/A	N/A	0
	N	27	80	100	225	432
	C	0	0	0	10	10
Total		27	80	100	235	442
Percentage Change from Previous Quarter						
		170%	196%	25%	135%	
Cumulative Total						
		43	123	223	458	
ASPs:						
NMOS		\$80.00	\$50.00	\$30.00	\$22.00	\$32.66
CMOS		0	0	\$45.00	\$25.00	\$25.00
Overall		\$80.00	\$50.00	\$30.00	\$22.13	\$32.49
Revenue (\$M)						
		2.2	4.0	3.0	5.2	14.4
Market Share						
U.S.		100.0%	100.0%	100.0%	89.4%	94.3%
Japan		0	0	0	10.6	5.7
Europe		0	0	0	0	0
Total		100.0%	100.0%	100.0%	100.0%	100.0%

S = Sampling
N/A = Not Available

(Continued)

MOS EPROM--Data

Table 7 (Continued)

512K MOS EPROM Shipment Data, 1984–1987

Company	MOS Process	1986				
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Year
AMD	N	175	280	540	400	1,395
Fujitsu	C	25	25	25	25	100
General Instrument	C	S	10	25	100	135
	OTP	N/A	N/A	S	5	5
Hitachi	N	N/A	S	60	300	360
	C	N/A	N/A	N/A	N/A	0
Intel	N	250	400	730	900	2,280
Mitsubishi	N	N/A	S	58	365	423
National Semi.	C	N/A	S	0	0	0
Oki Electric	N	N/A	N/A	S	S	0
Texas Instruments	C	N/A	N/A	S	50	50
Toshiba	N	50	150	300	400	900
	OTP	N/A	N/A	S	30	30
VLSI Technology	C	S	0	3	5	8
WaferScale Integ.	C	N/A	N/A	N/A	N/A	0
Others	C	S	S	S	5	15
	N	475	830	1,688	2,395	5,388
	C	25	40	58	190	313
Total		500	870	1,746	2,585	5,701
Percentage Change from Previous Quarter						
		113%	74%	101%	48%	
Cumulative Total		958	1,828	3,574	6,159	
ASPs:						
NMOS		\$14.00	\$12.00	\$12.00	\$11.00	\$11.74
CMOS		\$16.50	\$15.50	\$15.00	\$13.00	\$13.97
Overall		\$14.13	\$12.16	\$12.10	\$11.15	\$11.85
Revenue (\$M)		7.1	10.6	21.1	28.8	67.6
Market Share						
U.S.		85.0%	79.9%	74.6%	56.7%	68.2%
Japan		15.0	20.1	25.4	43.3	31.8
Europe		0	0	0	0	0
Total		100.0%	100.0%	100.0%	100.0%	100.0%

\$ = Sampling
N/A = Not Available

(Continued)

MOS EPROM--Data

Table 7 (Continued)

512K MOS EPROM Shipment Data, 1984-1987

Company	MOS Process	1987				Year
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	N	740	785	525	565	2,615
	C	S	5	25	435	465
Fujitsu	C	500	1,500	1,800	2,100	5,900
Hitachi	N	750	800	850	950	3,350
	C	S	0	0	0	0
Intel	N	800	1,200	1,800	2,700	6,500
Microchip Tech., Inc.	C	100	150	100	100	450
	OTP	10	10	20	20	60
Mitsubishi	N	750	800	1,200	1,450	4,200
National Semi.	C	0	0	0	0	0
NEC	C	N/A	S	0	1,050	1,050
Oki Electric	N	0	180	200	400	780
	N OTP	0	170	200	650	1,020
SGS-Thomson	N	N/A	1	50	350	401
Texas Instruments	C	100	200	300	400	1,000
Toshiba	N	550	500	600	700	2,350
	N OTP	200	180	180	170	730
VLSI Technology	C	5	5	5	8	23
WaferScale Integ.	C	0	0	0	0	0
	N	3,790	4,616	5,605	7,935	21,946
	C	715	1,870	2,250	4,113	8,948
Total		4,505	6,486	7,855	12,048	30,895
Percentage Change from Previous Quarter						
		74%	44%	21%	53%	
Cumulative Total						
		10,664	17,150	25,005	37,053	
ASPs: NMOS						
		\$10.00	\$ 9.00	\$7.78	\$6.80	\$8.07
CMOS						
		\$11.00	\$10.00	\$9.00	\$7.50	\$8.68
Overall						
		\$10.16	\$ 9.29	\$8.13	\$7.04	\$8.24
Revenue (\$M)						
		45.8	60.2	63.9	84.8	254.7
Market Share						
		39.0%	36.3%	35.3%	35.1%	36.0%
U.S.		61.0	63.7	64.0	62.0	62.7
Japan		0	0	0.6	2.9	1.3
Europe						
Total		100.0%	100.0%	100.0%	100.0%	100.0%

S = Sampling
N/A = Not Available

Source: Dataquest
April 1988

MOS EPROM--Data

Table 8

1-Mbit MOS EPROM Shipment Data, 1986-1987

Company	NOS Process	Technology Features	1986				Year
			1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	C	x16	1	1	4	6	12
Atmel	C	N/A	0	0	0	0	0
Fujitsu	C	x8, x16	N/A	S	S	1	1
General Instrument	C	x16	N/A	N/A	N/A	N/A	0
Hitachi	C	x8, x16	S	10	30	75	115
Intel	N	x8, x16	S	5	25	30	60
Motorola	C	N/A	S	S	S	0	0
National Semi.	C	x8, x16	N/A	N/A	N/A	S	0
NEC	C	x16	N/A	S	0	1	1
Oki Electric	C	x16	N/A	N/A	N/A	S	0
Texas Instruments	C	N/A	N/A	N/A	S	S	0
Toshiba	C	x8	N/A	S	5	15	20
Other	C	N/A	N/A	N/A	S	0	0
	N		0	5	25	30	60
	C		1	11	39	98	149
Total			1	16	64	128	209
Percentage Change from Previous Quarter			0	3,100%	300%	100%	
Cumulative Total			1	17	81	209	
ASPs:	NMOS		\$110.00	\$80.00	\$50.00	\$42.00	\$48.50
	CMOS		\$150.00	\$70.00	\$66.00	\$60.00	\$62.62
	Overall		\$150.00	\$73.13	\$59.75	\$55.78	\$58.56
Revenue (\$M)			0.1	1.2	3.8	7.1	12.2
Market Share							
	U.S.		100.0%	37.5%	45.3%	28.1%	34.3%
	Japan		0	62.5	54.7	71.9	65.7
	Europe		0	0	0	0	0
Total			100.0%	100.0%	100.0%	100.0%	100.0%

S = Sampling
N/A = Not Available

(Continued)

MOS EPROM--Data

Table 8 (Continued)

1-Mbit MOS EPROM Shipment Data, 1986-1987

Company	MOS Process	Technology Features	1987				Year
			1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	
AMD	C	x16	6	10	25	50	91
Fujitsu	C	x8, x16	N/A	8	5	10	15
Hitachi	C	x8, x16	0	70	150	250	470
Intel	N	x8, x16	50	30	80	150	310
Microchip Tech., Inc.	C		N/A	N/A	N/A	N/A	0
Mitsubishi	C	x8, x16	0	5	5	65	75
National Semi.	C	x8, x16	0	0	0	0	0
NEC	C	x8	N/A	0	50	300	350
	C	x16	N/A	0	50	100	150
Oki Electric	C	x8, x16	N/A	N/A	N/A	5	0
SGS-Thomson	C		N/A	N/A	N/A	N/A	0
Texas Instruments	C		0	0	0	0	0
Toshiba	C	x8, x16	20	40	40	50	150
	N		50	30	80	150	310
	C		26	125	325	825	1,301
Total			76	155	405	975	1,611
Percentage Change from Previous Quarter			104%	161%	141%		
Cumulative Total			285	440	845	1,820	
ASPs:							
NMOS			\$26.00	\$24.00	\$24.00	\$24.00	\$24.32
CMOS			\$40.00	\$32.00	\$28.00	\$26.00	\$27.36
Overall			\$30.79	\$30.45	\$27.21	\$25.69	\$26.77
Revenue (\$M)			2.3	4.7	11.0	25.1	43.1
Market Share							
U.S.			73.7%	25.8%	25.9%	20.5%	24.9%
Japan			26.3	74.2	74.1	79.5	75.1
Europe			0	0	0	0	0
Total			100.0%	100.0%	100.0%	100.0%	100.0%

S = Sampling
N/A = Not Available

Source: Dataquest
April 1988

MOS EPROM--Data

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