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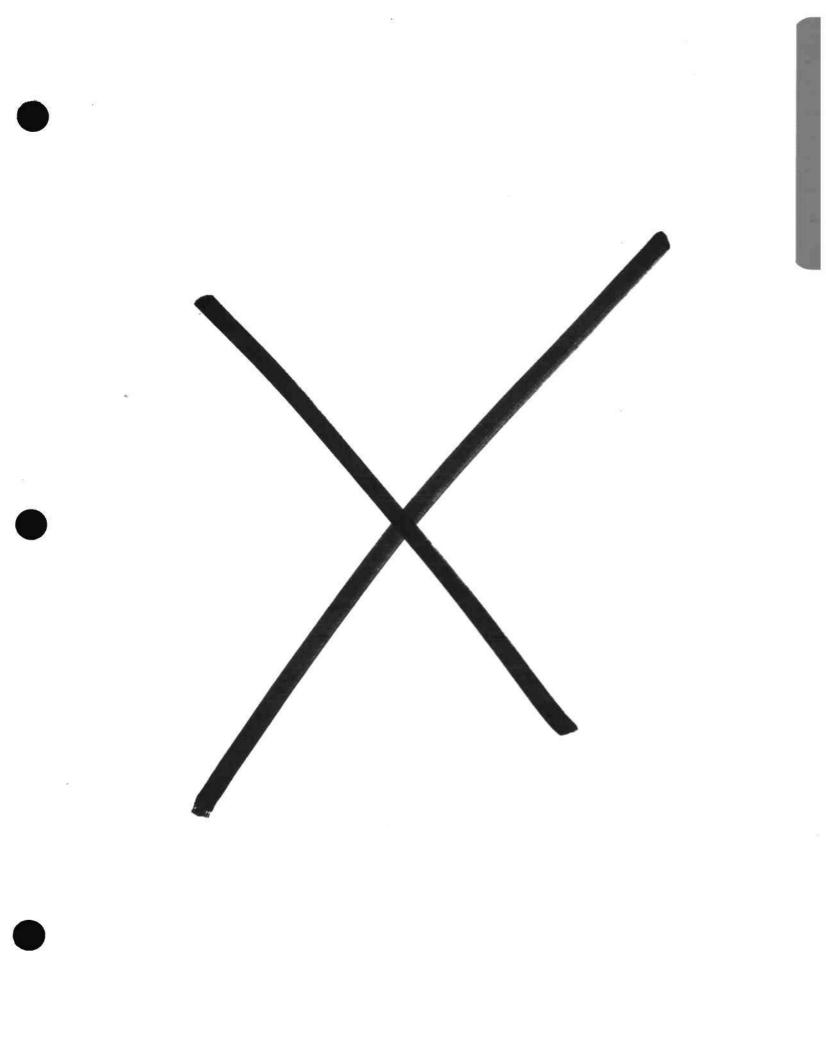
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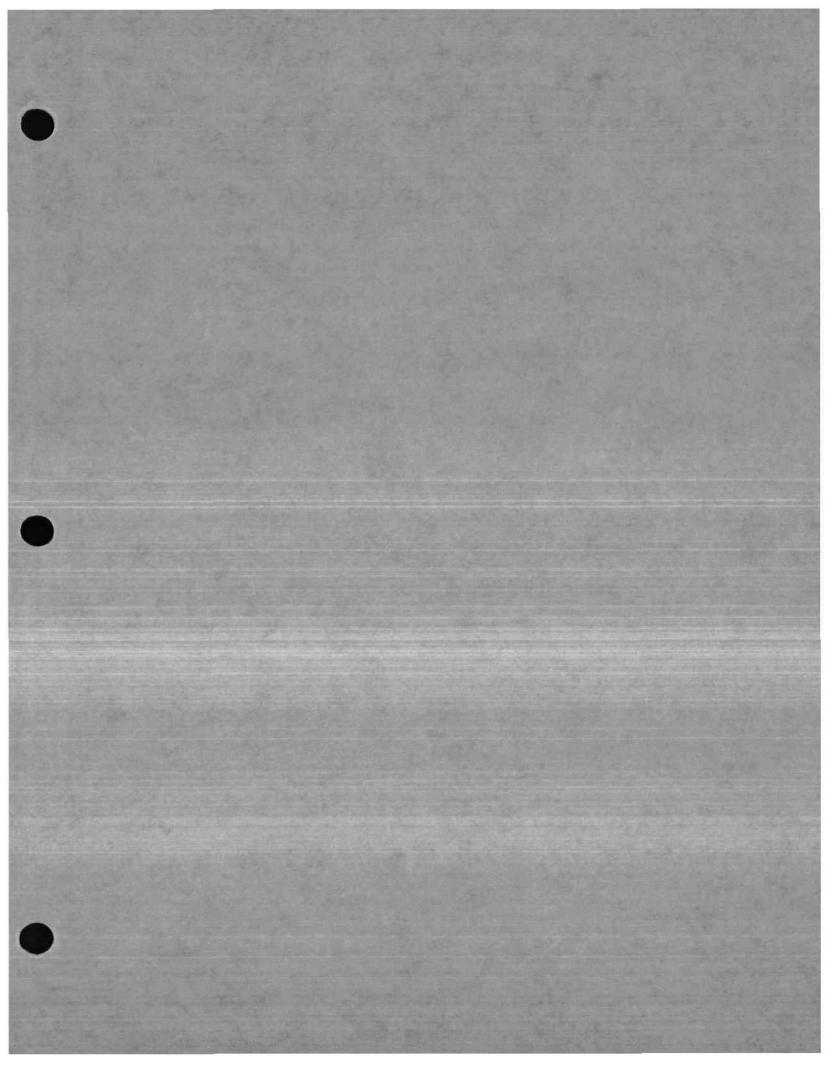
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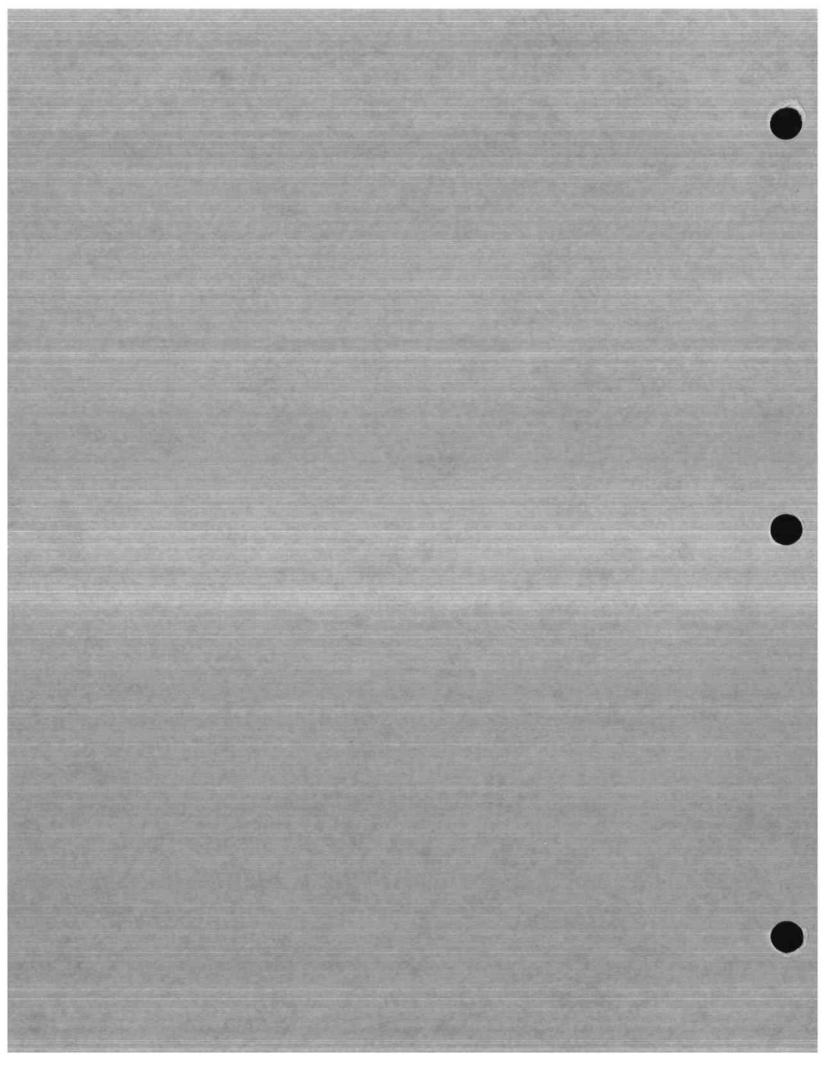
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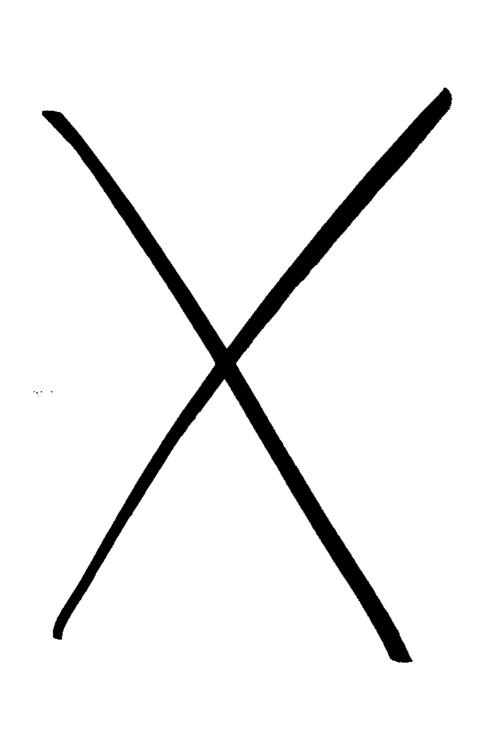
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4.

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	0.7 0.1	2.1	22.0	68.0	111.0	132.0		
4Mb 8Mb	0	0 0 0	0.7 0.1 0	2.1 0	22.0 0	68.0 0.1	111.0 0.7	132.0 5.3		
4Mb	0	0 0	0.7 0.1	2.1	22.0	68.0	111.0	132.0		
4Mb 8Mb	0	0 0 0	0.7 0.1 0	2.1 0	22.0 0	68.0 0.1	111.0 0.7	132.0 5.3		

Table 1 (Continued)

MOS EPROMs-Total Worldwide Market

			A	verage Se	elling Pr	ice `		
	1987	1988	1989	1990	1991	1992	1993	1994
4K	0	0	0	0	O	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)

Table 2
Worldwide NMOS EPROM Market—Total (UV and OTP)

	1007	1000		Millions o			1002	1004		
	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			2445	(40)	(88)	/	(5.5)	(0.0)		
Previous Year	15	6	(44)	(48)	(33)	(27)	(25)	(33)		
	Millions of Units									
				Millions	of Units					
	1987	1988	1989	Millions 1990	of Units 1991	1992	1993	1994		
4K	1987 0	1988 0	1989 0				1993	1 994 0		
4K 8K				1990	1991	1992				
	0	0	0	1990 0	1991 0	1992 0	0	0		
8K	0	0 0	0 0	1990 0 0	1991 0 0	1992 0 0	0 0	0 0		
8K 16K	0 0 7.3	0 0 5.3	0 0 4.5	1990 0 0 2.9	1991 0 0 2.1	1992 0 0 1.5	0 0 1.0	0 0 0.5		
8K 16K 32K	0 0 7.3 13.1	0 0 5.3 11.9	0 0 4.5 9.8	1990 0 0 2.9 8.0	1991 0 0 2.1 6.2	1992 0 0 1.5 4.7	0 0 1.0 3.8	0 0 0.5 3.0		
8K 16K 32K 64K	0 0 7.3 13.1 48.5	0 0 5.3 11.9 38.2	0 0 4.5 9.8 26.5	1990 0 0 2.9 8.0 16.0	1991 0 0 2.1 6.2 11.5	1992 0 0 1.5 4.7 8.0	0 0 1.0 3.8 5.2	0 0 0.5 3.0 4.0		
8K 16K 32K 64K 128K	0 7.3 13.1 48.5 46.3	0 0 5.3 11.9 38.2 45.4	0 0 4.5 9.8 26.5 26.4	1990 0 0 2.9 8.0 16.0 11.5	1991 0 0 2.1 6.2 11.5 6.8	0 0 1.5 4.7 8.0 3.0	0 0 1.0 3.8 5.2 1.5	0 0.5 3.0 4.0 0.5		
8K 16K 32K 64K 128K 256K	0 7.3 13.1 48.5 46.3 71.6	0 5.3 11.9 38.2 45.4 57.6	0 0 4.5 9.8 26.5 26.4 42.3	0 0 2.9 8.0 16.0 11.5 24.0	1991 0 0 2.1 6.2 11.5 6.8 15.0	0 0 1.5 4.7 8.0 3.0 11.0	0 0 1.0 3.8 5.2 1.5 8.0	0 0.5 3.0 4.0 0.5 6.0		
8K 16K 32K 64K 128K 256K 512K	0 7.3 13.1 48.5 46.3 71.6 22.2	0 5.3 11.9 38.2 45.4 57.6 32.4	0 0 4.5 9.8 26.5 26.4 42.3 30.2	0 0 2.9 8.0 16.0 11.5 24.0 25.5	0 0 2.1 6.2 11.5 6.8 15.0 15.4	0 0 1.5 4.7 8.0 3.0 11.0	0 1.0 3.8 5.2 1.5 8.0 6.0	0 0.5 3.0 4.0 0.5 6.0 3.0		
8K 16K 32K 64K 128K 256K 512K 1Mb	0 7.3 13.1 48.5 46.3 71.6 22.2 0.3	0 5.3 11.9 38.2 45.4 57.6 32.4 1.3	0 0 4.5 9.8 26.5 26.4 42.3 30.2	0 0 2.9 8.0 16.0 11.5 24.0 25.5 0	0 0 2.1 6.2 11.5 6.8 15.0 15.4	0 0 1.5 4.7 8.0 3.0 11.0 10.0	0 0 1.0 3.8 5.2 1.5 8.0 6.0	0 0.5 3.0 4.0 0.5 6.0 3.0		
8K 16K 32K 64K 128K 256K 512K 1Mb 2Mb	0 0 7.3 13.1 48.5 46.3 71.6 22.2 0.3 0	0 0 5.3 11.9 38.2 45.4 57.6 32.4 1.3 0	0 0 4.5 9.8 26.5 26.4 42.3 30.2 0	1990 0 0 2.9 8.0 16.0 11.5 24.0 25.5 0	1991 0 0 2.1 6.2 11.5 6.8 15.0 15.4 0	0 0 1.5 4.7 8.0 3.0 11.0 10.0	0 0 1.0 3.8 5.2 1.5 8.0 6.0 0	0 0.5 3.0 4.0 0.5 6.0 3.0 0		
8K 16K 32K 64K 128K 256K 512K 1Mb 2Mb	0 0 7.3 13.1 48.5 46.3 71.6 22.2 0.3 0	0 0 5.3 11.9 38.2 45.4 57.6 32.4 1.3 0	0 0 4.5 9.8 26.5 26.4 42.3 30.2 0 0	1990 0 0 2.9 8.0 16.0 11.5 24.0 25.5 0 0	1991 0 0 2.1 6.2 11.5 6.8 15.0 15.4 0 0	0 0 1.5 4.7 8.0 3.0 11.0 10.0 0	0 0 1.0 3.8 5.2 1.5 8.0 6.0 0	0 0.5 3.0 4.0 0.5 6.0 3.0 0		
8K 16K 32K 64K 128K 256K 512K 1Mb 2Mb 4Mb	0 0 7.3 13.1 48.5 46.3 71.6 22.2 0.3 0 0	0 0 5.3 11.9 38.2 45.4 57.6 32.4 1.3 0 0	0 0 4.5 9.8 26.5 26.4 42.3 30.2 0 0	1990 0 0 2.9 8.0 16.0 11.5 24.0 25.5 0 0	1991 0 0 2.1 6.2 11.5 6.8 15.0 15.4 0 0	1992 0 0 1.5 4.7 8.0 3.0 11.0 10.0 0 0	0 0 1.0 3.8 5.2 1.5 8.0 6.0 0 0	0 0 0.5 3.0 4.0 0.5 6.0 3.0 0 0		
8K 16K 32K 64K 128K 256K 512K 1Mb 2Mb 4Mb 8Mb 16Mb Total % Change from	0 0 7.3 13.1 48.5 46.3 71.6 22.2 0.3 0 0	0 0 5.3 11.9 38.2 45.4 57.6 32.4 1.3 0 0	0 0 4.5 9.8 26.5 26.4 42.3 30.2 0 0	1990 0 0 2.9 8.0 16.0 11.5 24.0 25.5 0 0 0	1991 0 0 2.1 6.2 11.5 6.8 15.0 15.4 0 0 0	1992 0 0 1.5 4.7 8.0 3.0 11.0 10.0 0 0 0	0 0 1.0 3.8 5.2 1.5 8.0 6.0 0 0 0 25.5	0 0 0.5 3.0 4.0 0.5 6.0 3.0 0 0		
8K 16K 32K 64K 128K 256K 512K 1Mb 2Mb 4Mb 8Mb 16Mb Total	0 0 7.3 13.1 48.5 46.3 71.6 22.2 0.3 0 0	0 0 5.3 11.9 38.2 45.4 57.6 32.4 1.3 0 0	0 0 4.5 9.8 26.5 26.4 42.3 30.2 0 0	1990 0 0 2.9 8.0 16.0 11.5 24.0 25.5 0 0 0	1991 0 0 2.1 6.2 11.5 6.8 15.0 15.4 0 0 0	1992 0 0 1.5 4.7 8.0 3.0 11.0 10.0 0 0 0	0 0 1.0 3.8 5.2 1.5 8.0 6.0 0 0	0 0 0.5 3.0 4.0 0.5 6.0 3.0 0 0		

Table 2 (Continued)

Worldwide NMOS EPROM Market—Total (UV and OTP)

			Av	erage Sel	ling Pric	e		
	1987	1988	1 98 9	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 % Change from	\$4.08	\$4.70	\$3.59	\$2.96	\$3.06	\$3.34	\$3.73	\$3.78
· Previous Year	27	15	(23)	(18)	3	9	12	1

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 % Change from	496	1,002	1,280	1,431	1,904	2,312	2,476	2,416			
Previous Year	187	102	28	12	33	21	7	(2)			
				Millions	of Unite						
	1987	1988	1989		of Units 1991	1992	1993	1994			
ΑV	1987	1988	1989	1990	1 99 1	1992	1993	1994			
4K	0	0	0	1990 0	1991 0	0	0	0			
8K	0 0	0 0	0 0	1990 0 0	1991 0 0	0 0	0	0			
8K 16K	0 0 2.4	0 0 3.7	0 0 4.0	1990 0 0 5.0	1991 0 0 5.0	0 0 5.0	0 0 5.0	0 0 5.1			
8K 16K 32K	0 0 2.4 3.1	0 0 3.7 4.1	0 0 4.0 3.8	1990 0 0 5.0 3.7	1991 0 0 5.0 3.5	0 0 5.0 3.3	0 0 5.0 3.2	0 0 5.1 3.0			
8K 16K 32K 64K	0 0 2.4 3.1 27.2	0 0 3.7 4.1 28.4	0 0 4.0 3.8 28.7	1990 0 0 5.0 3.7 34.0	1991 0 0 5.0 3.5 35.5	0 0 5.0 3.3 34.0	0 5.0 3.2 31.8	0 0 5.1 3.0 28.0			
8K 16K 32K 64K 128K	0 0 2.4 3.1 27.2 11.2	0 0 3.7 4.1 28.4 17.8	0 0 4.0 3.8 28.7 22.7	1990 0 5.0 3.7 34.0 22.5	1991 0 0 5.0 3.5 35.5 22.0	0 0 5.0 3.3 34.0 22.0	0 5.0 3.2 31.8 20.0	0 0 5.1 3.0 28.0 17.5			
8K 16K 32K 64K 128K 256K	0 0 2.4 3.1 27.2 11.2 46.9	0 0 3.7 4.1 28.4 17.8 78.7	0 0 4.0 3.8 28.7 22.7 109.0	1990 0 0 5.0 3.7 34.0 22.5 125.0	1991 0 0 5.0 3.5 35.5 22.0 117.0	0 0 5.0 3.3 34.0 22.0 99.0	0 5.0 3.2 31.8 20.0 86.0	0 5.1 3.0 28.0 17.5 80.0			
8K 16K 32K 64K 128K 256K 512K	0 0 2.4 3.1 27.2 11.2 46.9 8.7	0 0 3.7 4.1 28.4 17.8 78.7 24.7	0 0 4.0 3.8 28.7 22.7 109.0 51.8	1990 0 5.0 3.7 34.0 22.5 125.0 55.4	1991 0 0 5.0 3.5 35.5 22.0 117.0 54.6	0 0 5.0 3.3 34.0 22.0 99.0 45.0	0 5.0 3.2 31.8 20.0 86.0 40.0	0 0 5.1 3.0 28.0 17.5 80.0 36.0			
8K 16K 32K 64K 128K 256K 512K 1Mb	0 0 2.4 3.1 27.2 11.2 46.9 8.7 1.4	0 0 3.7 4.1 28.4 17.8 78.7 24.7 9.3	0 4.0 3.8 28.7 22.7 109.0 51.8 34.3	1990 0 5.0 3.7 34.0 22.5 125.0 55.4 64.0	1991 0 0 5.0 3.5 35.5 22.0 117.0 54.6 88.0	0 5.0 3.3 34.0 22.0 99.0 45.0 87.8	0 5.0 3.2 31.8 20.0 86.0 40.0 80.0	0 0 5.1 3.0 28.0 17.5 80.0 36.0 65.0			
8K 16K 32K 64K 128K 256K 512K 1Mb 2Mb	0 0 2.4 3.1 27.2 11.2 46.9 8.7 1.4	0 0 3.7 4.1 28.4 17.8 78.7 24.7 9.3 0	0 0 4.0 3.8 28.7 22.7 109.0 51.8 34.3 0.7	1990 0 5.0 3.7 34.0 22.5 125.0 55.4 64.0 5.8	1991 0 0 5.0 3.5 35.5 22.0 117.0 54.6 88.0 20.0	0 0 5.0 3.3 34.0 22.0 99.0 45.0 87.8 53.0	0 5.0 3.2 31.8 20.0 86.0 40.0 80.0 79.5	0 0 5.1 3.0 28.0 17.5 80.0 36.0 65.0 79.0			
8K 16K 32K 64K 128K 256K 512K 1Mb 2Mb 4Mb	0 0 2.4 3.1 27.2 11.2 46.9 8.7 1.4 0	0 0 3.7 4.1 28.4 17.8 78.7 24.7 9.3 0	0 0 4.0 3.8 28.7 22.7 109.0 51.8 34.3 0.7 0.1	1990 0 0 5.0 3.7 34.0 22.5 125.0 55.4 64.0 5.8 2.1	1991 0 0 5.0 3.5 35.5 22.0 117.0 54.6 88.0 20.0 22.0	0 0 5.0 3.3 34.0 22.0 99.0 45.0 87.8 53.0 68.0	0 5.0 3.2 31.8 20.0 86.0 40.0 80.0 79.5 111.0	0 0 5.1 3.0 28.0 17.5 80.0 36.0 65.0 79.0 132.0			
8K 16K 32K 64K 128K 256K 512K 1Mb 2Mb 4Mb	0 0 2.4 3.1 27.2 11.2 46.9 8.7 1.4 0 0	0 0 3.7 4.1 28.4 17.8 78.7 24.7 9.3 0 0	0 0 4.0 3.8 28.7 22.7 109.0 51.8 34.3 0.7 0.1	1990 0 0 5.0 3.7 34.0 22.5 125.0 55.4 64.0 5.8 2.1 0	1991 0 0 5.0 3.5 35.5 22.0 117.0 54.6 88.0 20.0 22.0 0	0 0 5.0 3.3 34.0 22.0 99.0 45.0 87.8 53.0 68.0 0.1	0 5.0 3.2 31.8 20.0 86.0 40.0 80.0 79.5 111.0 0.7	0 0 5.1 3.0 28.0 17.5 80.0 36.0 65.0 79.0 132.0 5.3			
8K 16K 32K 64K 128K 256K 512K 1Mb 2Mb 4Mb 8Mb 16Mb	0 0 2.4 3.1 27.2 11.2 46.9 8.7 1.4 0 0	0 0 3.7 4.1 28.4 17.8 78.7 24.7 9.3 0 0 0	0 0 4.0 3.8 28.7 22.7 109.0 51.8 34.3 0.7 0.1 0	1990 0 0 5.0 3.7 34.0 22.5 125.0 55.4 64.0 5.8 2.1 0	1991 0 0 5.0 3.5 35.5 22.0 117.0 54.6 88.0 20.0 22.0 0	0 0 5.0 3.3 34.0 22.0 99.0 45.0 87.8 53.0 68.0 0.1	0 5.0 3.2 31.8 20.0 86.0 40.0 80.0 79.5 111.0 0.7 0.1	0 0 5.1 3.0 28.0 17.5 80.0 36.0 65.0 79.0 132.0 5.3 0.9			
8K 16K 32K 64K 128K 256K 512K 1Mb 2Mb 4Mb	0 0 2.4 3.1 27.2 11.2 46.9 8.7 1.4 0 0	0 0 3.7 4.1 28.4 17.8 78.7 24.7 9.3 0 0	0 0 4.0 3.8 28.7 22.7 109.0 51.8 34.3 0.7 0.1	1990 0 0 5.0 3.7 34.0 22.5 125.0 55.4 64.0 5.8 2.1 0	1991 0 0 5.0 3.5 35.5 22.0 117.0 54.6 88.0 20.0 22.0 0	0 0 5.0 3.3 34.0 22.0 99.0 45.0 87.8 53.0 68.0 0.1	0 5.0 3.2 31.8 20.0 86.0 40.0 80.0 79.5 111.0 0.7	0 0 5.1 3.0 28.0 17.5 80.0 36.0 65.0 79.0 132.0 5.3			

Table 3 (Continued)
Worldwide CMOS EPROM Market—Total (UV and OTP)

			A	verage S	elling Pri	ice		
	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)
a 5								

Table 4
Worldwide MOS UV EPROM Market

			_		f 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
8МЬ	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	40	47	(3)	(0)			•	(6)
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	.0	20		(0)	2	E	~	151
Previous Year	*	2,2	8	(2)	3	6	5	(5)
								(Continued)

Table 4 (Continued)

Worldwide MOS UV EPROM Market

			A ¹	verage Se	elling Pri	ice		
	1987	1988	1989	1990	1991	1992	1993	1994
4K	0	0	O	O	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

Table 5
Worldwide MOS OTP EPROM Market Value

			ŀ	Millions o	of Dollar	S		
	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	7 9	87	100	104
512K	14	37	27	21	19	19	20	25
1 M b	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 % Change from	151	151	159	191	236	298	364	398
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

Table 5 (Continued)

Worldwide MOS OTP EPROM Market Value

			Av	erage Sel	lling Pric	e		
	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

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

Table 1

MOS EPROMs—Total Worldwide Market

			M	illions	of Dol	lars		
	1986	1987	<u> 1988</u>	<u> 1989</u>	1990	1991	1992	<u> 1993</u>
4K	0	0	0	0	0	0	0	0
8K	0	0	0	0	0	0	0	0
16K	\$ 35				•	•		
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	<u>136</u>
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%
	<u> 1986</u>	1987	M 1988	illions 1989	of Uni	1991	1992	1993
4K	0	0	0	0	0	0	0	0
8K	0	Ŏ	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		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	Q	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%

Table 1 (Continued)

MOS EPROMs-Total Worldwide Market

			Averag	<u>ge Sel</u> li	ing Pric	e (\$)		
	<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	\$ 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%

Table 2 Worldwide NMOS EPROM Market—Total (UV and OTP)

			Mi	llions	of Doll	ars		
	1986	1987	1988	<u>1989</u>	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
lMb	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%)
	1980	5 198			s of Un 9 199		1992	1993
4K	1980		<u>198</u>	1 <u>8</u> 198	9 199	<u>0 1991</u>		
4K 8K	1986	5 <u>198</u> 0					0	1993 0 0
8K		0	0 0	0 0	9 <u>199</u> 0 0	0 1991 0 (0 (0	0
	1986 14. 18.	0 0 .7 7	0 0 0 7.3 5	0 0 0 5.6 3	0 0 0 .5 2	0 1991 0 (0 (0 0 1.9	0
8K 15K	14.	0 0 .7 7	0 0 0 7.3 5	0 0 0 5.6 3	0 0 0 .5 2	0 1991 0 0 0 0	0 0 1.9 5.0	0 0 1.7
8K 16K 32K	14. · 18.	0 0 .7 7 .9 13	0 0 0 7.3 5 1.1 11	0 0 0 6.6 3 9 9	0 0 0 0 0 0 0 0 0 0 0 1.5 2 0.3 7	0 1993 0 0 0 0 .9 2.4	0 0 1.9 5.0 8.5	0 0 1.7 4.3
8K 16K 32K 64K	14. · 18. 82.	0 0 .7 .9 .5 .5 .4	0 0 0 7.3 5 3.1 11 3.5 38 3.3 44	0 0 0 6.6 3 .9 9 9.3 24	0 0 0 .5 2 .3 7 .0 15	0 1993 0 0 0 0 .9 2.4 .0 5.8	0 0 1.9 5.0 8.5 10.1	0 0 1.7 4.3 5.4
8K 16K 32K 64K 128K	14 · 18 · 82 · 55 · 53	0 0 .7 7 .9 13 .5 48 .4 46	0 0 0 1.3 5 1.1 1.5 38 1.3 44 1.6 58	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 .5 2.3 7 .0 15 1.1 26	0 1993 0 0 0 0 .9 2.4 .0 5.8 .0 11.5 .8 14.3 .0 19.0	0 0 0 1.9 3 5.0 5 8.5 10.1 18.8 11.0	0 0 1.7 4.3 5.4 7.6
8K 16K 32K 64K 128K 256K	14 · 18 · 82 · 55 · 53	0 0 .7 .9 .5 .4 .4 .8 .7 .4 .2	0 0 0 5 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 .5 2.3 7 .0 15 .1 26 .0 28	0 1993 0 0 0 0 .9 2.4 .0 5.8 .0 11.5 .8 14.3	0 0 0 1.9 3 5.0 5 8.5 10.1 18.8 11.0	0 0 1.7 4.3 5.4 7.6
8K 16K 32K 64K 128K 256K 512K 1Mb 2Mb	14 · 18 · 82 · 55 · 53	0 0 .7 .9 .5 .4 .4 .8 .7 .4 .2	0 0 0 3.3 5.1 1.5 3.8 3.3 4.4 3.6 5.8 3.2 3.9	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 .5 2.3 7 .0 15 .1 26 .0 28 .5 27 .2 5	0 1993 0 0 0 0 .9 2.4 .0 5.8 .0 11.5 .8 14.3 .0 19.0 .5 19.4 .0 2.8	0 0 1.9 5.0 8.5 10.1 18.8 11.0 0	0 1.7 4.3 5.4 7.6 11.5 6.0 1.7
8K 16K 32K 64K 128K 256K 512K 1Mb	14 · 18 · 82 · 55 · 53	0 0 .7 .9 .5 .4 .4 .8 .7 .4 .2 .1	0 0 0 3.3 5 3.1 11 3.5 38 3.3 44 3.6 58 3.2 39 3.3 1	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 .5 2 .3 7 .0 15 .1 26 .0 28 .5 27 .2 5	0 1993 0 0 0 9 2.4 .0 5.8 .0 11.5 .8 14.3 .0 19.0 .5 19.4 .0 2.8	0 0 1.9 5.0 8.5 10.1 18.8 11.0 0	0 1.7 4.3 5.4 7.6 11.5 6.0
8K 16K 32K 64K 128K 256K 512K 1Mb 2Mb	14 · 18 · 82 · 55 · 53	0 0 .7 .9 .5 .4 .4 .4 .6 .8 .7 .1 .0	0 0 0 3.3 5.1 1.5 3.8 3.3 4.4 3.6 5.8 3.2 3.9	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 .5 2.3 7 .0 15 .1 26 .0 28 .5 27 .2 5	0 1993 0 0 0 0 .9 2.4 .0 5.8 .0 11.5 .8 14.3 .0 19.0 .5 19.4 .0 2.8	0 0 0 1.9 5.0 8.5 10.1 18.8 11.0 0 0	0 1.7 4.3 5.4 7.6 11.5 6.0 1.7
8K 16K 32K 64K 128K 256K 512K 1Mb 2Mb 4Mb	14 · 18 · 82 · 55 · 53	0 0 .7 .9 .5 .4 .4 .8 .7 .1 .0 0	0 0 0 5 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 .5 2 3 7 .0 15 .1 26 .0 28 .5 27 .2 5 0 0	0 1993 0 0 0 0 0 9 2.4 .0 5.8 .0 11.5 .8 14.3 .0 19.6 .0 2.8 0 0 0 0	0 0 1.9 5.0 8.5 10.1 18.8 11.0 2.0 0	0 0 1.7 4.3 5.4 7.6 11.5 6.0 1.7 0
8K 15K 32K 64K 128K 256K 512K 1Mb 2Mb 4Mb	14 · 18 · 82 · 55 · 53 · 5 · 0	0 0 .7 .9 .5 .4 .4 .8 .7 .1 .0 0	0 0 0 5 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 .5 2 3 7 .0 15 .1 26 .0 28 .5 27 .2 5 0 0	0 1993 0 0 0 0 0 9 2.4 .0 5.8 .0 11.5 .8 14.3 .0 19.6 .0 2.8 0 0 0 0	0 0 1.9 5.0 8.5 10.1 18.8 11.0 2.0 0	0 0 1.7 4.3 5.4 7.6 11.5 6.0 1.7 0

Table 2 (Continued) Worldwide NMOS EPROM Market—Total (UV and OTP)

			Average	Selling	7 Price	(\$)		
	1986	<u> 1987</u>	1988	1989	1990	<u> 1991</u>	<u> 1992</u>	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%

Table 3
Worldwide CMOS EPROM Market—Total (UV and OTP)

					Milli	ons o	of Do	11a	rs		
	1986	198	7 198		1989		990		991	1992	1993
4K	0		0	0	0)	0		0	() 0
8K	0		0	0	0		0		0	(
16K	0	\$	8 \$ 1	L6 \$	19	\$	17	\$	18	\$ 19	\$ 19
32K	\$ 7	1	.0	8	9	•	13		13	13	13
64K	65	8	4 10	9	152		168		172	13!	98
128K	7	4	.5 8	30	96	,	84		62	59	56
256K	80	23	6 37	72	415	;	400		359	337	340
512K	4	7	5 17	70	258	:	265		231	204	189
1Mb	9	3	8 14	18	448		674		733	639	543
2Mb	0		0	0	11		25		119	44!	648
4Mb	0		0 :	18	77		182		536	802	1,096
8Mb	0		<u> </u>	<u> </u>	0	<u> </u>	0	_	Q		136
Total	\$173	\$49	6 \$93	20 \$	1,485	\$1.	,827	\$2	,243	\$2,65	\$3,138
% Change from											
Previous Year	60%	187	% 8!	5%	619	•	23%		23%	199	18%
											•
							s of				
	19	<u>86</u>	<u> 1987</u>	198	<u> 88</u> <u>1</u>	<u>.989</u>	<u>199</u>	<u>0</u>	<u>1991</u>	<u>1997</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		1.1	4.3		.1	4.		5 4.5
32K		.7	3.1		.0	2.3		.0	з.		.0 3.0
64K		.1	27.2		.0	37.0	39		40.		
128K		. 9	11.2		.8	21.9	20		14.		
256K		. 2	46.9		8.8	92.0		.0	83.		
512K		.3	8.7		7	40.5		.0	49.		
1Mb	0	.1	1.4	7	.8	32.0	63		85.		
2Mb		0	0		0	0.3		. 4	10.		
4Mb		0	0	0),2	1.7	7	.0	36.		
8Mb		0	0		_0 _	0		0		0 _0	1 4.0
Total	38	.3	100.8	152	.4 2	32.0	281	.7	326.	4 388	6 451.4
% Change from	_			_			-				
Previous Year	8	2%	163%	5	1%	52%	2	18	16	% 1º	9% 16%

Table 3 (Continued) Worldwide CMOS EPROM Market—Total (UV and OTP)

			Averag	re Sell:	ing Pric	ce (\$)		_
	1986	<u>1987</u>	1988	1989	1990	<u> 1991</u>	<u>1992</u>	<u>1993</u>
4K	0	o	o	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%

Table 4
Worldwide MOS UV EPROM Market—Total (NMOS and CMOS)

			M	<u>illions</u>	of Dol	lars		
	1986	<u>1987</u>	1988	1989	1990	<u>1991</u>	<u>1992</u>	<u>1993</u>
4K	0	0	0	0	0	0	0	0
8K	Ö	0	0	Ö	Ó	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
dM8	0	0	0	0	0	0	5	<u>136</u>
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%
		_		<u>illions</u>				
	1986	1987	<u>м</u> 1988	<u>illions</u> 1989	of Uni 1990	1991	1992	1993
4K	0	0		<u>1989</u> 0	<u>1990</u> 0	1991 0	0	0
8K	0	0	1988 0 0	1989 0 0	1990 0 0	1991 0 0	0	0
8K 16K	0 0 14.7	0 0 9.7	1988 0 0 8.6	1989 0 0 7.8	1990 0 0 7.0	1991 0 0 6.8	0 0 6.4	0 0 6.2
8K 16K 32K	0 0 14.7 20.7	0 0 9.7 16.2	1988 0 0 8.6 13.9	1989 0 0 7.8 11.6	1990 0 0 7.0 10.0	1991 0 0 6.8 8.8	0 0 6.4 8.0	0 0 6.2 7.3
8K 16K 32K 64K	0 0 14.7 20.7 93.9	0 9.7 16.2 56.3	1988 0 0 8.6 13.9 58.8	1989 0 0 7.8 11.6 56.1	1990 0 0 7.0 10.0 51.0	1991 0 0 6.8 8.8 50.4	0 0 6.4 8.0 39.5	0 0 6.2 7.3 28.0
8K 16K 32K 64K 128K	0 14.7 20.7 93.9 52.2	0 9.7 16.2 56.3 50.3	1988 0 0 8.6 13.9 58.8 55.8	1989 0 0 7.8 11.6 56.1 53.9	1990 0 7.0 10.0 51.0 44.6	1991 0 6.8 8.8 50.4 27.8	0 6.4 8.0 39.5 23.4	0 6.2 7.3 28.0 20.1
8K 16K 32K 64K 128K 256K	0 14.7 20.7 93.9 52.2 57.5	0 9.7 16.2 56.3 50.3	1988 0 0 8.6 13.9 58.8 55.8 115.3	1989 0 0 7.8 11.6 56.1 53.9 117.0	1990 0 7.0 10.0 51.0 44.6 112.7	1991 0 0 6.8 8.8 50.4 27.8 95.1	0 6.4 8.0 39.5 23.4 89.3	0 6.2 7.3 28.0 20.1 81.5
8K 16K 32K 64K 128K	0 14.7 20.7 93.9 52.2 57.5	0 9.7 16.2 56.3 50.3 100.8 29.0	1988 0 0 8.6 13.9 58.8 55.8 115.3 55.0	1989 0 7.8 11.6 56.1 53.9 117.0 63.0	1990 0 7.0 10.0 51.0 44.6 112.7 61.8	1991 0 6.8 8.8 50.4 27.8 95.1 55.0	0 6.4 8.0 39.5 23.4 89.3 41.9	0 6.2 7.3 28.0 20.1 81.5 34.5
8K 16K 32K 64K 128K 256K 512K 1Mb	0 14.7 20.7 93.9 52.2 57.5 5.7 0.2	0 9.7 16.2 56.3 50.3 100.8 29.0	1988 0 0 8.6 13.9 58.8 55.8 115.3 55.0 8.7	1989 0 7.8 11.6 56.1 53.9 117.0 63.0 34.2	1990 0 7.0 10.0 51.0 44.6 112.7 61.8 57.0	1991 0 6.8 8.8 50.4 27.8 95.1 55.0 68.0	0 6.4 8.0 39.5 23.4 89.3 41.9 63.8	0 6.2 7.3 28.0 20.1 81.5 34.5 61.5
8K 16K 32K 64K 128K 256K 512K 1Mb 2Mb	0 14.7 20.7 93.9 52.2 57.5	0 9.7 16.2 56.3 50.3 100.8 29.0	1988 0 0 8.6 13.9 58.8 55.8 115.3 55.0 8.7	1989 0 7.8 11.6 56.1 53.9 117.0 63.0 34.2 0.3	1990 0 7.0 10.0 51.0 44.6 112.7 61.8 57.0	1991 0 6.8 8.8 50.4 27.8 95.1 55.0 68.0 7.0	0 6.4 8.0 39.5 23.4 89.3 41.9 63.8 42.0	0 6.2 7.3 28.0 20.1 81.5 34.5 61.5
8K 16K 32K 64K 128K 256K 512K 1Mb 2Mb	0 14.7 20.7 93.9 52.2 57.5 5.7 0.2	0 9.7 16.2 56.3 50.3 100.8 29.0 1.7 0	1988 0 0 8.6 13.9 58.8 55.8 115.3 55.0 8.7 0	1989 0 7.8 11.6 56.1 53.9 117.0 63.0 34.2 0.3 1.7	1990 0 7.0 10.0 51.0 44.6 112.7 61.8 57.0 1.3 6.2	1991 0 6.8 8.8 50.4 27.8 95.1 55.0 68.0 7.0 32.0	0 6.4 8.0 39.5 23.4 89.3 41.9 63.8 42.0	0 6.2 7.3 28.0 20.1 81.5 34.5 61.5 65.0
8K 16K 32K 64K 128K 256K 512K 1Mb 2Mb	0 14.7 20.7 93.9 52.2 57.5 5.7 0.2	0 9.7 16.2 56.3 50.3 100.8 29.0	1988 0 0 8.6 13.9 58.8 55.8 115.3 55.0 8.7	1989 0 7.8 11.6 56.1 53.9 117.0 63.0 34.2 0.3	1990 0 7.0 10.0 51.0 44.6 112.7 61.8 57.0	1991 0 6.8 8.8 50.4 27.8 95.1 55.0 68.0 7.0	0 6.4 8.0 39.5 23.4 89.3 41.9 63.8 42.0	0 6.2 7.3 28.0 20.1 81.5 34.5 61.5
8K 16K 32K 64K 128K 256K 512K 1Mb 2Mb	0 0 14.7 20.7 93.9 52.2 57.5 5.7 0.2 0	0 9.7 16.2 56.3 50.3 100.8 29.0 1.7 0	1988 0 0 8.6 13.9 58.8 55.8 115.3 55.0 8.7 0	1989 0 7.8 11.6 56.1 53.9 117.0 63.0 34.2 0.3 1.7	1990 0 7.0 10.0 51.0 44.6 112.7 61.8 57.0 1.3 6.2	1991 0 6.8 8.8 50.4 27.8 95.1 55.0 68.0 7.0 32.0	0 6.4 8.0 39.5 23.4 89.3 41.9 63.8 42.0	0 6.2 7.3 28.0 20.1 81.5 34.5 61.5 65.0
8K 16K 32K 64K 128K 256K 512K 1Mb 2Mb 4Mb	0 0 14.7 20.7 93.9 52.2 57.5 5.7 0.2 0	0 9.7 16.2 56.3 50.3 100.8 29.0 1.7 0	1988 0 0 8.6 13.9 58.8 55.8 115.3 55.0 8.7 0	1989 0 7.8 11.6 56.1 53.9 117.0 63.0 34.2 0.3 1.7	1990 7.0 10.0 51.0 44.6 112.7 61.8 57.0 1.3 6.2	1991 0 6.8 8.8 50.4 27.8 95.1 55.0 68.0 7.0 32.0	0 6.4 8.0 39.5 23.4 89.3 41.9 63.8 42.0 70.0	0 6.2 7.3 28.0 20.1 81.5 34.5 61.5 65.0 106.0

Table 4 (Continued) Worldwide MOS UV EPROM Market—Total (NMOS and CMOS)

.94	Average Selling Price (\$)							
	<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	\$ 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		\$ 7.45
2Mb	O	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

Table 5 Worldwide NMOS UV EPROM Market

•			Mi	llions	of Doll	ars		
•	<u>1986</u>	<u> 1987</u>	1988	<u>1989</u>	1990	<u> 1991</u>	1992	<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	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%)
				• •	• •	, -		, =
			Mi	llions	of Unit	۹.		
	1986	1987	Mi 1988	<u>llions</u> 1989	of Unit 1990	s 1991	1992	1993
4K	<u>1986</u> 0	<u>1987</u> 0					<u>1992</u> 0	<u>1993</u> 0
4K 8K	·		<u>1988</u>	1989	<u>1990</u>	<u>1991</u>		
	0	0	<u>1988</u> 0	<u>1989</u> 0	<u>1990</u> 0	<u>1991</u> 0	0	0
8K	0	0	1988 0 0	1989 0	1990 0 0	1991 0 0	0	0
8K 16K	0 0 14.7	0 0 7.3	1988 0 0 5.6	1989 0 0 3.5	1990 0 0 2.9	1991 0 0 2.4	0 0 1.9	0 0 1.7
8K 16K 32K 64K 128K	0 0 14.7 18.1	0 0 7.3 13.1	1988 0 0 5.6 11.9	1989 0 0 3.5 9.3	1990 0 0 2.9 7.0	1991 0 0 2.4 5.8	0 0 1.9 5.0	0 0 1.7 4.3
8K 16K 32K 64K 128K 256K	0 0 14.7 18.1 77.6	0 0 7.3 13.1 40.6	1988 0 0 5.6 11.9 35.1	1989 0 0 3.5 9.3 22.1	1990 0 0 2.9 7.0 14.0	1991 0 0 2.4 5.8 11.1	0 0 1.9 5.0 8.5	0 0 1.7 4.3 5.4
8K 16K 32K 64K 128K 256K 512K	0 0 14.7 18.1 77.6 50.3	0 7.3 13.1 40.6 39.5	1988 0 0 5.6 11.9 35.1 39.7	1989 0 0 3.5 9.3 22.1 33.8	1990 0 0 2.9 7.0 14.0 25.6	1991 0 0 2.4 5.8 11.1 13.7	0 0 1.9 5.0 8.5	0 0 1.7 4.3 5.4 7.6
8K 16K 32K 64K 128K 256K 512K 1Mb	0 0 14.7 18.1 77.6 50.3 43.4 5.4	0 7.3 13.1 40.6 39.5 56.9 20.4 0.3	1988 0 0 5.6 11.9 35.1 39.7 51.7 34.3 1.3	1989 0 0 3.5 9.3 22.1 33.8 33.9	1990 0 0 2.9 7.0 14.0 25.6 25.0	1991 0 0 2.4 5.8 11.1 13.7 16.9	0 1.9 5.0 8.5 10.1 14.0	0 0 1.7 4.3 5.4 7.6
8K 16K 32K 64K 128K 256K 512K 1Mb 2Mb	0 0 14.7 18.1 77.6 50.3 43.4 5.4 0.1	0 7.3 13.1 40.6 39.5 56.9 20.4 0.3	1988 0 0 5.6 11.9 35.1 39.7 51.7 34.3 1.3	1989 0 0 3.5 9.3 22.1 33.8 33.9 27.5	1990 0 0 2.9 7.0 14.0 25.6 25.0 20.5	1991 0 0 2.4 5.8 11.1 13.7 16.9	0 1.9 5.0 8.5 10.1 14.0 7.4 2.0	0 1.7 4.3 5.4 7.6 10.5 3.0
8K 16K 32K 64K 128K 256K 512K 1Mb 2Mb 4Mb	0 0 14.7 18.1 77.6 50.3 43.4 5.4	0 7.3 13.1 40.6 39.5 56.9 20.4 0.3 0	1988 0 0 5.6 11.9 35.1 39.7 51.7 34.3 1.3	1989 0 0 3.5 9.3 22.1 33.8 33.9 27.5 5.2	1990 0 0 2.9 7.0 14.0 25.6 25.0 20.5 5.0	1991 0 0 2.4 5.8 11.1 13.7 16.9 14.4 2.8	0 1.9 5.0 8.5 10.1 14.0 7.4 2.0	0 1.7 4.3 5.4 7.6 10.5 3.0
8K 16K 32K 64K 128K 256K 512K 1Mb 2Mb	0 0 14.7 18.1 77.6 50.3 43.4 5.4 0.1	0 7.3 13.1 40.6 39.5 56.9 20.4 0.3	1988 0 0 5.6 11.9 35.1 39.7 51.7 34.3 1.3	1989 0 0 3.5 9.3 22.1 33.8 33.9 27.5 5.2	1990 0 0 2.9 7.0 14.0 25.6 25.0 20.5 5.0	1991 0 0 2.4 5.8 11.1 13.7 16.9 14.4 2.8	0 1.9 5.0 8.5 10.1 14.0 7.4 2.0	0 1.7 4.3 5.4 7.6 10.5 3.0 1.7
8K 16K 32K 64K 128K 256K 512K 1Mb 2Mb 4Mb	0 0 14.7 18.1 77.6 50.3 43.4 5.4 0.1	0 7.3 13.1 40.6 39.5 56.9 20.4 0.3 0	1988 0 0 5.6 11.9 35.1 39.7 51.7 34.3 1.3 0	1989 0 0 3.5 9.3 22.1 33.8 33.9 27.5 5.2 0	1990 0 0 2.9 7.0 14.0 25.6 25.0 20.5 5.0	1991 0 0 2.4 5.8 11.1 13.7 16.9 14.4 2.8 0	0 0 1.9 5.0 8.5 10.1 14.0 7.4 2.0 0	0 0 1.7 4.3 5.4 7.6 10.5 3.0 1.7 0
8K 16K 32K 64K 128K 256K 512K 1Mb 2Mb 4Mb	0 0 14.7 18.1 77.6 50.3 43.4 5.4 0.1 0	0 0 7.3 13.1 40.6 39.5 56.9 20.4 0.3 0	1988 0 0 5.6 11.9 35.1 39.7 51.7 34.3 1.3 0 0	1989 0 3.5 9.3 22.1 33.8 33.9 27.5 5.2 0	1990 0 0 2.9 7.0 14.0 25.6 25.0 20.5 5.0 0	1991 0 0 2.4 5.8 11.1 13.7 16.9 14.4 2.8 0	0 0 1.9 5.0 8.5 10.1 14.0 7.4 2.0 0	0 0 1.7 4.3 5.4 7.6 10.5 3.0 1.7 0

Table 5 (Continued) **Worldwide NMOS UV EPROM Market**

			Averag	<u>e Sellin</u>	g Price	(\$)		
	1986	1987	<u>1988</u>	1989	1990	<u>1991</u>	<u>1992</u>	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
dM8	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%

Table 6
Worldwide CMOS UV EPROM Market

				Mil	lions	of D	ollar	`S_		
	1986	198	7 198			1990		991	1992	1993
4K	0	(0	0	0		0	0	0	0
8K	0	(0	0	0		0	0	0	0
16K	0		8 \$ 1	.6 \$	19 8	\$ 1		18	\$ 19	\$ 19
32K	\$ 7	10		8	9	1		13	13	13
64K	63	5			143	15		171	137	102
128K	7	4		3	89	8		62	60	57
256K	70	22			386	38		352	350	339
512K	4	7			234	22		199	169	165
1Mb	9	3			413	57		580	470	446
2Mb	0	I		0	11		4	86	389	546
4Mb	0	1	0 1	.8	77	16	3	486	721	896
8Mb	0	'	<u> </u>	٥	0	· <u> </u>	<u> </u>	0	5	<u>136</u>
Total	\$161	\$45	4 \$85	5 \$1,	382	\$1,64	9 \$1	.,967	\$2,332	\$2,719
% Change from										
Previous Year	54%	181	% 88	*	62%	19	%	19%	19%	17%
	ī	986	1987	1988	Milli 198		<u>f Uni</u> 990	ts 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	1	6.3	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	1	4.1	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	3	5.3	86.0	136.8	210	.3 2	51.6	283.	8 335.5	379.9
% Change from										
Previous Year		76%	143%	59%	5	4%	20%	13	% 18%	13%

Table 6 (Continued)

Worldwide CMOS UV EPROM Market

			Averac	ge Selli	ing Pric	e (\$)		
	1986	1987	1988	1989	1990	<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	\$ 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
lMb	\$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
8Мь	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

Table 7 Worldwide MOS OTP EPROM Market—Total (NMOS and CMOS)

			Mi	llions (of Dolla	ars		
	<u> 1986</u>	1987	1988	1989	<u>1990</u>	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	<u>87</u>	_140
Total	\$72	\$151	\$142	\$188	\$227	\$305	\$359	\$435
% Change from								
Previo us Yea r	259%	111%	(6%)	32%	20%	35%	18%	21%
	es.							
					•			
		1005		<u>illions</u>				4000
	198 <u>6</u>	1987	1988	illions 1989	of Uni 1990	<u>1991</u>	1992	1993
4K	1986 0	<u>1987</u> 0					<u>1992</u> 0	<u>1993</u> 0
8K	0		1988	<u>1989</u> 0 0	<u>1990</u>	<u> 1991</u>		0
	0	0	<u>1988</u> 0	<u>1989</u> 0	<u>1990</u> 0	<u>1991</u> 0	0	0
8K	0	0	1988 0 0	<u>1989</u> 0 0	1990 0 0	1991 0 0	0	0
8K 16K	0	0 0 0	1988 0 0 0	1989 0 0 0	1990 0 0	1991 0 0 0	0 0 0	0 0 0
8K 16K 32K 64K 128K	0 0 0	0 0 0	1988 0 0 0	1989 0 0 0	1990 0 0 0	1991 0 0 0 0	0 0 0	0 0 0
8K 16K 32K 64K 128K 256K	0 0 0 0.9 5.7	0 0 0 0 19.3	1988 0 0 0 0 0	1989 0 0 0 0 4.9	1990 0 0 0 0 3.0	1991 0 0 0 0 0	0 0 0 0	0 0 0 0
8K 16K 32K 64K 128K	0 0 0.9 5.7 5.2	0 0 0 0 19.3 7.2	1988 0 0 0 0 6.5 6.2	1989 0 0 0 0 4.9 4.1	1990 0 0 0 0 3.0 2.4	1991 0 0 0 0 1.6 1.0	0 0 0 0 0.5	0 0 0 0
8K 16K 32K 64K 128K 256K	0 0 0.9 5.7 5.2 12.5	0 0 0 0 19.3 7.2 17.6	1988 0 0 0 0 6.5 6.2 15.5	1989 0 0 0 0 4.9 4.1	1990 0 0 0 0 3.0 2.4 9.3	1991 0 0 0 0 1.6 1.0 6.9	0 0 0 0.5 0.2 5.7	0 0 0 0 0
8K 16K 32K 64K 128K 256K 512K	0 0 0.9 5.7 5.2 12.5	0 0 0 19.3 7.2 17.6	1988 0 0 0 0 6.5 6.2 15.5	1989 0 0 0 0 4.9 4.1 13.0 15.0	1990 0 0 0 3.0 2.4 9.3 15.7	1991 0 0 0 0 1.6 1.0 6.9	0 0 0 0.5 0.2 5.7	0 0 0 0 0 0 4.5
8K 16K 32K 64K 128K 256K 512K 1Mb	0 0 0.9 5.7 5.2 12.5 0	0 0 0 19.3 7.2 17.6 1.8	1988 0 0 0 0 6.5 6.2 15.5 6.0	1989 0 0 0 4.9 4.1 13.0 15.0	1990 0 0 0 3.0 2.4 9.3 15.7	1991 0 0 0 0 1.6 1.0 6.9 14.0	0 0 0 0.5 0.2 5.7 12.1 24.0	0 0 0 0 0 4.5 10.5 23.5
8K 16K 32K 64K 128K 256K 512K 1Mb 2Mb	0 0 0.9 5.7 5.2 12.5 0	0 0 0 19.3 7.2 17.6 1.8 0	1988 0 0 0 0 6.5 6.2 15.5 6.0 0.3	1989 0 0 0 4.9 4.1 13.0 15.0 3.0	1990 0 0 0 3.0 2.4 9.3 15.7 11.0	1991 0 0 0 0 1.6 1.0 6.9 14.0 20.0	0 0 0 0.5 0.2 5.7 12.1 24.0 8.0	0 0 0 0 0 4.5 10.5 23.5
8K 16K 32K 64K 128K 256K 512K 1Mb 2Mb 4Mb	0 0 0.9 5.7 5.2 12.5 0 0	0 0 0 19.3 7.2 17.6 1.8 0	1988 0 0 0 6.5 6.2 15.5 6.0 0.3 0	1989 0 0 0 4.9 4.1 13.0 15.0 3.0 0	1990 0 0 0 3.0 2.4 9.3 15.7 11.0 0.1	1991 0 0 0 1.6 1.0 6.9 14.0 20.0 3.0 4.0	0 0 0 0.5 0.2 5.7 12.1 24.0 8.0	0 0 0 0 0 4.5 10.5 23.5 17.0 20.0

Table 7 (Continued) Worldwide MOS OTP EPROM Market—Total (NMOS and CMOS)

			Averag	re Selli	ing Pric	e (\$)		
	<u>1986</u>	<u>1987</u>	1988	1989	1990	<u>1991</u>	1992	<u>1993</u>
4K	0	0	0	0	0	0	0	0
8K .	Ö	0	0	0	0	0	0	0
16K	0	0	0	0	Ó	0	0	Ó
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

Table 8
Worldwide NMOS OTP EPROM Market

	Millions of Dollars									
	<u>19</u>	86	1987	198	<u>8 1989</u>	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 1		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	26	6%	72%	(28) 5	(44)	(36)	(32)	(19)	
	Millions of Units									
	1986	19	87	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	8.6	4.5	2.3	1.2	0.4	0	0	
256K	10.4	14	1.7	6.3	4.1	3.0	2.1	1.5	1.0	
512K	0	1	L.8	4.9	10.0	7.0	5.0	3.6	3.0	
1Mb	N/A		1/A	N/A	N/A	N/A	N/A	N/A	N/A	
2Mb	N/A	ľ	I/A	N/A	N/A	N/A	N/A	N/A	N/A	
4Mb	<u> N/A</u>	_1	1/ <u>A</u>	N/A	_N/A	<u> </u>	<u>N/A</u>	<u>N/A</u>	<u>N/A</u>	
Total	21.4	31	L.2	18.8	18.3	12.2	7.9	5.1	4.0	

Table 8 (Continued)

Worldwide NMOS OTP EPROM Market

	Average Selling Price (\$)								
	1986	1987	1988	1989	1990	<u>1991</u>	1992	<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	\$ 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

Table 9 Worldwide CMOS OTP EPROM Market

	Millions of Dollars							
	1986	1987	1988	<u>1989</u>	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	O	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	<u>87</u>	<u>140</u>
Total	\$11	\$46	\$67	\$109	\$182	\$276	\$339	\$420
% Change from								
Previous Year	228%	330%	46%	63%	67%	52%	23%	24%
			wi	llions	af Mait	_		
	1986	1987	1988	1989	1990	<u> 1991</u>	1992	1993
4 75	N / 3	W (3	NT (3	W / 3	NT / 3	NI ()	NT / 3	N7 / 3
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	N/A
16K	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	<u>N/A</u>	<u>N/A</u>	<u> </u>	0	0.8	4.0	11.0	<u>20.0</u>
Total	2.9	14.8	15.6	21.7	30.1	42.6	56.4	71.5

Table 9 (Continued)

Worldwide CMOS OTP EPROM Market

	Average Selling Price (\$)							
	<u>1986</u>	<u>1987</u>	1988	<u>1989</u>	1990	<u>1991</u>	<u>1992</u>	<u>1993</u>
4 K	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
1Мь	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

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

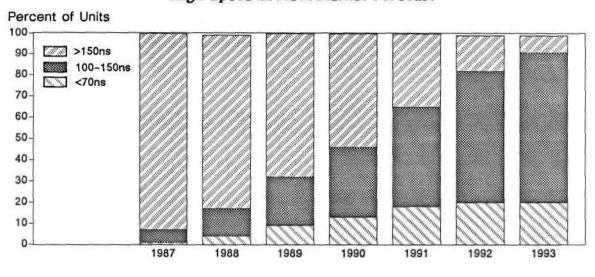
Although worldwide EPROM production and shipments grew 13 percent in 1988, strong demand and continued high ASPs were the greatest contributors to strong revenue growth in 1988. Although U.S. and European EPROM suppliers continued to benefit from MITI-imposed production reductions, EPROM users were forced 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,

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.

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

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.

Table 10
1989 2Mb/4Mb CMOS EPROM Suppliers

	Fastest	2	МЪ	4	МЬ
<u>Company</u>	<u>Speed</u>	<u>x8</u>	x16	<u>x8</u>	<u>×16</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 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.

Table 1
Worldwide Market Forecast—Total MOS ROMs

			Value	(Millio	ns of Do	llars)_		
	1986	<u>1987</u>	1988	<u>1989</u>	1990	<u> 1991</u>	<u>1992</u>	<u> 1993</u>
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
32МЬ	0	0	Q	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)		
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
8МЪ	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	Ö	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

Table 1 (Continued) Worldwide Market Forecast—Total MOS ROMs

		A	verage S	elling P	rice (Do	llars/Un	it)	
	1986	<u>19</u> 87	1988	1989	1990	<u>1991</u>	1992	<u>1993</u>
4K	0	0	0	0	0	0	0	0
8K	\$ 3.25	Ō	Ô	Ď	Ō	Ō	Ō	0
16K	\$ 2.50	\$ 2.50	\$ 2.50	\$ 2.50	0	ō	Ō	Ō
32K	\$ 1.50	\$ 1.50	\$ 1.55	\$ 1.60	\$ 1.60	\$ 1.65	\$ 1.65	Ö
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
4МЬ	\$32.00	\$16.00	\$10.00	\$ 8.00	\$ 6.00	\$ 5.10	\$ 4.40	\$ 4.00
8МЬ	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

Table 2
Worldwide NMOS ROM Market Forecast

			Value	(Million	ns of Do	llars)		
	<u> 1986</u>	1987	1988	1989	1990	1991	1992	<u> 1993</u>
	_	_	_		_	_		
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	0
512K	23	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%)
				<u> Units (M</u>	il <u>lions)</u>			
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	A\N	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	<u>N/A</u>	N/A	<u>N/A</u>	N/A	<u> </u>	<u> </u>	<u> </u>
Total	105.1	37.9	31.4	15.3	7.5	3.0	0.5	0

Table 2 (Continued) Worldwide NMOS ROM Market Forecast

			Average (Selling 1	Price (Do	ollars/Un	nit)	
	1986	<u>1987</u>	<u>1988</u>	1989	<u>1990</u>	<u> 1991</u>	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
2МЪ	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

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Table 3
Worldwide CMOS ROM Market Forecast

(Continued)	(Con							
269.5	271.0	265.5	260.2	244,0	218.9	155.9	55.2	Total
0.2	0	N/A	A/N	A/N_	A/N	A/N	N/A	64Mb
14.0	3.1	0.2	0	N/A	N/A	N/A	M/W	32Mb
68.0	55.0	18.0	2.0	0.1	0	A/N	A/N	16Mb
90.0	74.0	37.0	14.0	1.0	0.1	0	N/A	8 <u>M</u>
50.0	70.0	97.0	72.0	49.0	18.6	1.4	0.1	4 ₩
22.0	32.0	54.0	84.0	58.0	37.1	6.4	0.4	2Mb
16.0	20.0	26.0	34.0	58.0	84.6	54.7	7.0	TAP
o. 5	11.0	19.0	28.0	39.0	31.3	27.7	5.0	512K
2.8	4.8	8.0	13.2	21.0	26.8	37.0	23.8	256K
0	0.1	0.3	1.0	3.0	5.6	12.4	8.0	128K
0	1.0	6.0	12.0	14.7	13.0	13.1	7.6	64K
0	0	0	0	0	1.3	2.7	1.8	32K
0	0	0	0	0.2	0.5	0.5	0.5	16K
0	0	0	0	0	0	0	1.0	X 8
0	0	0	0	0	0	0	0	4K
			(Millions)	Units (Mi	g			
8	14%	10%	4.00	18%	56%	226%		Year
								Percent Change from Previous
\$1,572	\$1,451	\$1,276	\$1,156	\$1,107	\$936	\$598	\$183	Total
10	2	0	0	0	6	0	6	64%0
266	84	9	۲	0	0	0	0	32Mb
483	435	167	24	٦	0	0	0	16000
486	429	259	116	11	_	0	0	8Mb
200	308	495	432	392	186	22	ω	4Mb
69	109	205	361	307	215	56	9	2MG
38	50	73	109	220	347	284	55	TAP TAP
,	23	42	67	106	101	114	29	512K
€	9	15	24	39	52	75	54	256K
0		-	2	ζī	9	22	14	128K
0	\$	\$ 11	\$ 20	24	21	20	11	64K
0	0	0	0	o	2	44	ω	32K
0	0	0	0	**	\$	⇔ . ⊢	_	16K
0	0	0	0	0	0	0	69 ω	8K
0	0	0	0	0	0	0	0	4K
1993	1992	<u> 1991</u>	<u>1990</u>		<u> 1988</u>	1987	<u> 1986</u>	
		llars	(Millions of Dollars		Value			

Table 3 (Continued)

Worldwide CMOS ROM Market Forecast

			Average	Selling	Price (D	ollars/U	nit)	
	<u> 1986</u>	1987	1988	1989	<u>1990</u>	<u>1991</u>	<u>1992</u>	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

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

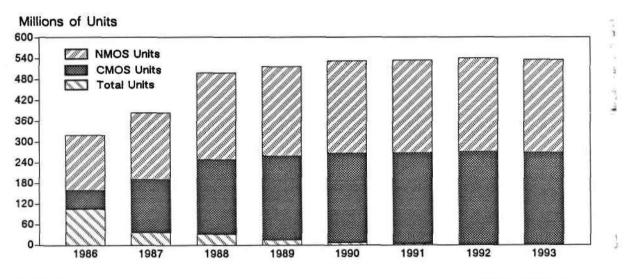
As indicated in the 1988 forecast, CMOS has grown significantly over NMOS. As demand continues for larger memory capacity, higher speed, and low power, we anticipate that CMOS will command the larger portion of total ROM unit share. CMOS is becoming the dominant technology in all of the MOS memory areas 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.

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.

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.

Dataquest's MOS EPROM data consist of revenue, unit shipments, and prices for MOS EPROM product lines. Table I 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

Table 1

MOS EPROMs—Total Worldwide Market

			M:	illions	of Dol	lars		
	1986	<u>1987</u>	<u>1988</u>	<u>1989</u>	1990	1991	1992	1993
4K	0	0	0	0	0	0	0	0
8K	0	0	0	0	0	0	0	0
16K	\$ 35			\$ 31	\$ 28	\$ 28	\$ 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
dM8	0		<u>0</u>	0	0	0	5	<u>136</u>
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%
			M.					
				<u>illions</u>				
	1986	1987	1988	1989	1990	1991	1992	1993
4K	0	0	<u>1988</u> 0	<u>1989</u> 0	<u>1990</u> 0	<u>1991</u> 0	<u>1992</u> 0	0
8K	0	0	1988 0 0	1989 0 0	<u>1990</u> 0 0	1991 0 0	0	0
8K 16K	0 0 14.7	0 0 9.7	1988 0 0 8.6	1989 0 0 7.8	1990 0 0 7.0	1991 0 0 6.8	0 0 6.4	0 0 6.2
8K 16K 32K	0 0 14.7 21.6	0 0 9.7 16.2	1988 0 0 8.6 13.9	1989 0 0 7.8 11.6	1990 0 0 7.0 10.0	1991 0 0 6.8 8.8	0 0 6.4 8.0	0 0 6.2 7.3
8K 16K 32K 64K	0 0 14.7 21.6 99.6	0 9.7 16.2 75.7	1988 0 0 8.6 13.9 65.3	1989 0 0 7.8 11.6 61.0	1990 0 7.0 10.0 54.0	1991 0 0 6.8 8.8 52.0	0 6.4 8.0 40.0	0 0 6.2 7.3 28.0
8K 16K 32K 64K 128K	0 0 14.7 21.6 99.6 57.3	0 9.7 16.2 75.7 57.6	1988 0 0 8.6 13.9 65.3 61.9	1989 0 7.8 11.6 61.0 58.0	1990 0 7.0 10.0 54.0 47.0	1991 0 6.8 8.8 52.0 28.8	0 6.4 8.0 40.0 23.6	0 0 6.2 7.3 28.0 20.1
8K 16K 32K 64K 128K 256K	0 0 14.7 21.6 99.6 57.3 70.0	0 9.7 16.2 75.7 57.6 118.4	1988 0 0 8.6 13.9 65.3 61.9 130.8	1989 0 7.8 11.6 61.0 58.0 130.0	1990 0 7.0 10.0 54.0 47.0 122.0	1991 0 0 6.8 8.8 52.0 28.8 102.0	0 6.4 8.0 40.0 23.6 95.0	0 6.2 7.3 28.0 20.1 86.0
8K 16K 32K 64K 128K 256K 512K	0 0 14.7 21.6 99.6 57.3 70.0 5.7	0 9.7 16.2 75.7 57.6 118.4 30.9	1988 0 0 8.6 13.9 65.3 61.9 130.8 60.9	1989 0 7.8 11.6 61.0 58.0 130.0 78.0	1990 0 7.0 10.0 54.0 47.0 122.0 77.5	1991 0 0 6.8 8.8 52.0 28.8 102.0 69.0	0 6.4 8.0 40.0 23.6 95.0 54.0	0 6.2 7.3 28.0 20.1 86.0 45.0
8K 16K 32K 64K 128K 256K	0 0 14.7 21.6 99.6 57.3 70.0	0 9.7 16.2 75.7 57.6 118.4	1988 0 0 8.6 13.9 65.3 61.9 130.8	1989 0 7.8 11.6 61.0 58.0 130.0	1990 0 7.0 10.0 54.0 47.0 122.0	1991 0 0 6.8 8.8 52.0 28.8 102.0 69.0	0 6.4 8.0 40.0 23.6 95.0	0 6.2 7.3 28.0 20.1 86.0 45.0
8K 16K 32K 64K 128K 256K 512K 1Mb 2Mb	0 0 14.7 21.6 99.6 57.3 70.0 5.7	0 9.7 16.2 75.7 57.6 118.4 30.9	1988 0 8.6 13.9 65.3 61.9 130.8 60.9 9.0	1989 0 7.8 11.6 61.0 58.0 130.0 78.0 37.2 0.3	1990 0 7.0 10.0 54.0 47.0 122.0 77.5 68.0 1.4	1991 0 0 6.8 8.8 52.0 28.8 102.0 69.0 88.0 10.0	0 6.4 8.0 40.0 23.6 95.0 54.0 87.8 50.0	0 6.2 7.3 28.0 20.1 86.0 45.0 85.0
8K 16K 32K 64K 128K 256K 512K 1Mb 2Mb 4Mb	0 14.7 21.6 99.6 57.3 70.0 5.7	0 9.7 16.2 75.7 57.6 118.4 30.9	1988 0 0 8.6 13.9 65.3 61.9 130.8 60.9 9.0 0.2	1989 0 7.8 11.6 61.0 58.0 130.0 78.0 37.2	1990 0 7.0 10.0 54.0 47.0 122.0 77.5 68.0 1.4 7.0	1991 0 0 6.8 8.8 52.0 28.8 102.0 69.0 88.0	0 6.4 8.0 40.0 23.6 95.0 54.0 87.8 50.0 81.0	0 6.2 7.3 28.0 20.1 86.0 45.0 85.0 82.0
8K 16K 32K 64K 128K 256K 512K 1Mb 2Mb	0 14.7 21.6 99.6 57.3 70.0 5.7 0.2	0 9.7 16.2 75.7 57.6 118.4 30.9 1.7	1988 0 8.6 13.9 65.3 61.9 130.8 60.9 9.0	1989 0 7.8 11.6 61.0 58.0 130.0 78.0 37.2 0.3	1990 0 7.0 10.0 54.0 47.0 122.0 77.5 68.0 1.4	1991 0 0 6.8 8.8 52.0 28.8 102.0 69.0 88.0 10.0	0 6.4 8.0 40.0 23.6 95.0 54.0 87.8 50.0	0 6.2 7.3 28.0 20.1 86.0 45.0 85.0
8K 16K 32K 64K 128K 256K 512K 1Mb 2Mb 4Mb	0 0 14.7 21.6 99.6 57.3 70.0 5.7 0.2	0 9.7 16.2 75.7 57.6 118.4 30.9 1.7	1988 0 0 8.6 13.9 65.3 61.9 130.8 60.9 9.0 0.2	1989 0 7.8 11.6 61.0 58.0 130.0 78.0 37.2 0.3 1.7	1990 0 7.0 10.0 54.0 47.0 122.0 77.5 68.0 1.4 7.0	1991 0 0 6.8 8.8 52.0 28.8 102.0 69.0 88.0 10.0 36.0	0 6.4 8.0 40.0 23.6 95.0 54.0 87.8 50.0 81.0	0 6.2 7.3 28.0 20.1 86.0 45.0 85.0 82.0
8K 16K 32K 64K 128K 256K 512K 1Mb 2Mb 4Mb	0 0 14.7 21.6 99.6 57.3 70.0 5.7 0.2 0	0 9.7 16.2 75.7 57.6 118.4 30.9 1.7 0	1988 0 8.6 13.9 65.3 61.9 130.8 60.9 9.0 0.2	1989 0 7.8 11.6 61.0 58.0 130.0 78.0 37.2 0.3 1.7	1990 0 7.0 10.0 54.0 47.0 122.0 77.5 68.0 1.4 7.0	1991 0 6.8 8.8 52.0 28.8 102.0 69.0 88.0 10.0 36.0	0 6.4 8.0 40.0 23.6 95.0 54.0 87.8 50.0 81.0	0 6.2 7.3 28.0 20.1 86.0 45.0 85.0 82.0 126.0

Table 1 (Continued)

MOS EPROMs—Total Worldwide Market

			Avera	ge Sell	ing Pri	ce <u>(\$)</u>		
	1986	1987	1988	1989	1990	1991	1992	<u>1993</u>
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

Table 2
Worldwide NMOS EPROM Market—Total (UV and OTP)

		Millions of Dollars								
	1986	<u> 1987</u>	1988	1989	<u>1990</u>	<u>1991</u>	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%)		
				Willia	A 110					
	1980	6 198			s of Un 9 199		1992	1993		
	130	2 2 3 0	1 +34	<u> </u>	2 227	A ====	4274	<u> </u>		
4K .		0		_						
8K		•	0	0	0	0 0	0	0		
ov.		ŏ	0	0	0	0 0	0	0		
16K	14	0 .7 7	0 '.3 5	0 5.6 3	0 1.5 2	0 0 .9 2.4	0 1.9	0 1.7		
	18	0 .7 7 .9 13	0 7.3 5 7.1 11	0 5.6 3	0 1.5 2 1.3 7	0 0 .9 2.4 .0 5.8	0 1.9 5.0	0 1.7 4.3		
16K	18 82	0 .7 7 .9 13	0 7.3 5 7.1 11 7.5 38	0 5.6 3 1.9 9	0 1.5 2 1.3 7 1.0 15	0 0 .9 2.4 .0 5.8	0 1.9 5.0 8.5	0 1.7 4.3 5.4		
16K 32K 64K 128K	18 82 55	0 .7 7 .9 13 .5 48	0 3.3 5 3.1 11 3.5 38 3.3 44	0 5.6 3 1.9 9 1.3 24	0 1.5 2 1.3 7 1.0 15 1.1 26	0 0 .9 2.4 .0 5.8 .0 11.5 .8 14.1	0 1.9 5.0 8.5 10.1	0 1.7 4.3 5.4 7.6		
16K 32K 64K 128K 256K	18. 82. 55. 53.	0 .7 7 .9 13 .5 48 .4 46	0 .3 5 .1 11 .5 38 .3 44 .6 58	0 5.6 3 1.9 9 3.3 24 4.1 36 3.0 38	0 3.5 2 3.3 7 3.0 15 3.1 26 3.0 28	0 0 .9 2.4 .0 5.8 .0 11.5 .8 14.1	0 1.9 5.0 8.5 10.1 18.8	0 1.7 4.3 5.4 7.6 11.5		
16K 32K 64K 128K 256K 512K	18 82 55 53	0 .7 7 .9 13 .5 48 .4 46 .8 71	0 .3 5 .1 11 .5 38 .3 44 .6 58	0 5.6 3 1.9 9 1.3 24 1.1 36 1.0 38 0.2 37	0 1.5 2 1.3 7 1.0 15 1.1 26 1.0 28 1.5 27	0 0 .9 2.4 .0 5.8 .0 11.5 .8 14.1 .0 19.0	0 1.9 5.0 8.5 10.1 18.8 11.0	0 1.7 4.3 5.4 7.6 11.5 6.0		
16K 32K 64K 128K 256K 512K 1Mb	18 82 55 53	0 .7 .7 .9 .13 .5 .48 .4 .4 .6 .8 .71 .4 .22 .1 .0	0 .3 5 .1 11 .5 38 .3 44 .6 58	0 5.6 3 1.9 9 1.3 24 1.1 36 1.0 38 0.2 37	0 1.5 2 1.3 7 1.0 15 1.1 26 1.0 28 1.5 27	0 0 .9 2.4 .0 5.8 .0 11.5 .8 14.1 .0 19.0 .5 19.4	0 1.9 5.0 8.5 10.1 18.8 11.0 2.0	0 1.7 4.3 5.4 7.6 11.5 6.0		
16K 32K 64K 128K 256K 512K 1Mb 2Mb	18 82 55 53	0 .7 .7 .9 .13 .5 .48 .4 .4 .6 .8 .71 .4 .22 .1 0	0 3.3 5 1.1 11 3.5 38 3.3 44 3.6 58 3.2 39 3.3 1	0 5.6 3 9 9 9.3 24 9.1 3.6 3.8 9.2 3.7	0 1.5 2 1.3 7 1.0 15 1.1 26 1.0 28 1.5 27 1.2 5	0 0 .9 2.4 .0 5.8 .0 11.5 .8 14.1 .0 19.0 .5 19.4 .0 2.8 0 0	0 1.9 5.0 8.5 10.1 18.8 11.0 2.0	0 1.7 4.3 5.4 7.6 11.5 6.0 1.7		
16K 32K 64K 128K 256K 512K 1Mb 2Mb	18 82 55 53	0 .7 .7 .9 .13 .5 .48 .4 .4 .6 .8 .71 .4 .22 .1 .0 0	0 3.3 5 1.1 11 3.5 38 3.3 44 3.6 58 3.2 39 3.3 1 0 0	0 5.6 3 9 9 9.3 24 1.1 3.6 3.0 3.7 1.3 5 0	0 1.5 2 1.3 7 1.0 15 1.1 26 1.0 28 2.5 27 3.2 5 0	0 0 .9 2.4 .0 5.8 .0 11.5 .8 14.1 .0 19.0 .5 19.4 .0 2.8 0 0	0 1.9 5.0 8.5 10.1 18.8 11.0 2.0 0	0 1.7 4.3 5.4 7.6 11.5 6.0 1.7 0		
16K 32K 64K 128K 256K 512K 1Mb 2Mb	18 82 55 53	0 .7 .7 .9 .13 .5 .48 .4 .4 .6 .8 .71 .4 .22 .1 0	0 3.3 5 1.1 11 3.5 38 3.3 44 3.6 58 3.2 39 3.3 1	0 5.6 3 9 9 9.3 24 9.1 3.6 3.8 9.2 3.7	0 1.5 2 1.3 7 1.0 15 1.1 26 1.0 28 1.5 27 1.2 5	0 0 .9 2.4 .0 5.8 .0 11.5 .8 14.1 .0 19.0 .5 19.4 .0 2.8 0 0	0 1.9 5.0 8.5 10.1 18.8 11.0 2.0	0 1.7 4.3 5.4 7.6 11.5 6.0 1.7		
16K 32K 64K 128K 256K 512K 1Mb 2Mb	18 82 55 53	0 .7 .7 .7 .9 .13 .5 .4 .4 .4 .6 .6 .7 .1 .0 .0 .0	0 3.3 5 3.1 11 3.5 38 3.3 44 3.6 58 3.2 39 3.3 1 0 0	0 3.6 3.9 3.3 3.1 3.0 3.8 3.2 3.7 3.8 3.9 3.0 3.8 3.0 3.8 3.7 3.8 3.8 3.9 3.9 3.9 3.9 3.9 3.9 3.9 3.9	0 1.5 2 1.3 7 1.0 15 1.1 26 1.0 28 1.5 27 1.2 5 0 0	0 0 .9 2.4 .0 5.8 .0 11.5 .8 14.1 .0 19.0 .5 19.4 .0 2.8 0 0 0 0	0 1.9 5.0 8.5 10.1 18.8 11.0 2.0 0	0 1.7 4.3 5.4 7.6 11.5 6.0 1.7 0		
16K 32K 64K 128K 256K 512K 1Mb 2Mb 4Mb	18 82 55 53 5 0	0 .7 .7 .9 .13 .5 .48 .4 .4 .6 .8 .71 .4 .22 .1 .0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 3.3 5 3.1 11 3.5 38 3.3 44 3.6 58 3.2 39 3.3 1 0 0 0	0 3.6 3.9 3.3 3.1 3.0 3.8 3.2 3.7 3.8 3.9 3.0 3.8 3.0 3.8 3.7 3.8 3.8 3.9 3.9 3.9 3.9 3.9 3.9 3.9 3.9	0 1.5 2 1.3 7 1.0 15 1.1 26 1.0 28 1.5 27 5 0 0 0	0 0 .9 2.4 .0 5.8 .0 11.5 .8 14.1 .0 19.0 .5 19.4 .0 2.8 0 0 0 0	0 1.9 5.0 8.5 10.1 18.8 11.0 2.0 0 0 	0 1.7 4.3 5.4 7.6 11.5 6.0 1.7 0 0		

Table 2 (Continued)
Worldwide NMOS EPROM Market—Total (UV and OTP)

		i	Average	Selline	7 Price	(\$)		
	1986	1987	1988	1989	1990	1991	<u>1992</u>	1993
48	o	0	0	0	0	0	0	0
8K	0	Ö	0	Ó	Ó	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
4МВ	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

Table 3
Worldwide CMOS EPROM Market—Total (UV and OTP)

					Mi	11io	ns (of Do	11a:	rs			
	1986	198	7 19	88	<u>19</u>	89	19	990	1	991	1	992	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	1	0	8		9		13		13		13	13
64K	65	8	4 1	09	;	152		168		172		135	98
128K	7	4		80		96		84		62		59	56
256K	80	23		72		415		400		359		337	340
512K	4	7		70		258		265		231		204	189
1Mb	9	3		48	•	448		674		733		639	543
2Mb	0		0	0		11		25		119		445	648
4Mb	0			18		77		182		536		802	1,096
8Mb	0		ያ	0		0		0		0	_	5	136
Total	\$173	\$49	6 \$9	20	\$1,	485	\$1,	827	\$2	, 243	\$2	2,658	\$3,138
% Change from Previous Year	60%	187	% 8	5%	1	61%		23%		23%		19%	18%
					,	หลาก	ione	s of 1	lin i	t e			
	19	86	1987	1	988	19		199		1991		<u>1992</u>	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		.1	27.2		27.0	3	7.0	39	.0	40.	5	31.5	22.6
128K	1	. 9	11.2		17.8	2	1.9	20	. 2	14.	7	13.5	12.5
256K	16	. 2	46.9		72.8	93	2.0	94	.0	83.	0	76.2	74.5
512K	0	.3	8.7		21.7	4	0.5	50	.0	49.	6	43.0	39.0
1Mb	0	.1	1.4		7.8	3	2.0	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
8МЬ		<u> </u>	0	_	0		0		0		<u>0</u>	0.1	4.0
Total	38	.3	100.8	1	52.4	23	2.0	281	.7	326.	4	388.6	451.4
% Change from													
Previous Year	8	2%	163%		51%	!	52%	2	1%	16	ъ	19%	16%

Table 3 (Continued)
Worldwide CMOS EPROM Market—Total (UV and OTP)

	Average Selling Price (\$)							
	1986	1987	1988	<u> 1989</u>	1990	<u>1991</u>	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

Table 4
Worldwide MOS UV EPROM Market—Total (NMOS and CMOS)

			M:	illions	of Dol	lars		
	1986	1987	1988	1989	1990	1991	1992	1993
4 K	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	2 72	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
8МЬ	<u> </u>	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%
	1986	1987	<u>M</u> 1988	<u> 1989</u>	of Unio	<u>1991</u>	1992	1993
4K			1988	1989	1990	<u>1991</u>	1992 0	
4K 8K	1986 0 0	0	<u>1988</u> 0					1993 0 0
4K 8K 16K	0		1988	<u>1989</u> 0	<u>1990</u> 0	<u>1991</u> 0	0	0
8K	0 0 14.7	0	1988 0 0	1989 0 0	1990 0 7.0	1991 0 0	0	0
8K 16K	0	0 0 9.7	1988 0 0 8.6	1989 0 0 7.8	1990 0 0	1991 0 0 6.8 8.8	0 0 6.4 8.0	0 0 6.2
8K 16K 32K	0 0 14.7 20.7	0 0 9.7 16.2	1988 0 0 8.6 13.9	1989 0 0 7.8 11.6	1990 0 0 7.0 10.0	1991 0 6.8 8.8 50.4	0 0 6.4 8.0 39.5	0 0 6.2 7.3
8K 16K 32K 64K	0 0 14.7 20.7 93.9	0 9.7 16.2 56.3	1988 0 0 8.6 13.9 58.8	1989 0 0 7.8 11.6 56.1	1990 0 7.0 10.0 51.0 44.6	1991 0 6.8 8.8 50.4 27.8	0 6.4 8.0 39.5 23.4	0 0 6.2 7.3 28.0
8K 16K 32K 64K 128K	0 0 14.7 20.7 93.9 52.2	0 9.7 16.2 56.3 50.3	1988 0 0 8.6 13.9 58.8 55.8	1989 0 0 7.8 11.6 56.1 53.9	1990 0 7.0 10.0 51.0 44.6	1991 0 6.8 8.8 50.4 27.8 95.1	0 6.4 8.0 39.5 23.4 89.3	0 6.2 7.3 28.0 20.1 81.5
8K 16K 32K 64K 128K 256K	0 0 14.7 20.7 93.9 52.2 57.5	0 9.7 16.2 56.3 50.3	1988 0 0 8.6 13.9 58.8 55.8 115.3	1989 0 7.8 11.6 56.1 53.9 117.0 63.0	1990 0 7.0 10.0 51.0 44.6 112.7	1991 0 6.8 8.8 50.4 27.8 95.1 55.0	0 6.4 8.0 39.5 23.4 89.3 41.9	0 6.2 7.3 28.0 20.1 81.5 34.5
8K 16K 32K 64K 128K 256K 512K	0 0 14.7 20.7 93.9 52.2 57.5	0 9.7 16.2 56.3 50.3 100.8 29.0	1988 0 0 8.6 13.9 58.8 55.8 115.3 55.0	1989 0 7.8 11.6 56.1 53.9 117.0 63.0	1990 0 7.0 10.0 51.0 44.6 112.7 61.8	1991 0 6.8 8.8 50.4 27.8 95.1 55.0	0 6.4 8.0 39.5 23.4 89.3 41.9 63.8	0 6.2 7.3 28.0 20.1 81.5 34.5 61.5
8K 16K 32K 64K 128K 256K 512K 1Mb	0 0 14.7 20.7 93.9 52.2 57.5 5.7	0 9.7 16.2 56.3 50.3 100.8 29.0	1988 0 0 8.6 13.9 58.8 55.8 115.3 55.0 8.7	1989 0 7.8 11.6 56.1 53.9 117.0 63.0 34.2	1990 0 7.0 10.0 51.0 44.6 112.7 61.8 57.0	1991 0 6.8 8.8 50.4 27.8 95.1 55.0 68.0	0 6.4 8.0 39.5 23.4 89.3 41.9 63.8	0 6.2 7.3 28.0 20.1 81.5 34.5 61.5
8K 16K 32K 64K 128K 256K 512K 1Mb 2Mb	0 0 14.7 20.7 93.9 52.2 57.5 5.7 0.2	0 9.7 16.2 56.3 50.3 100.8 29.0 1.7	1988 0 0 8.6 13.9 58.8 55.8 115.3 55.0 8.7	1989 0 7.8 11.6 56.1 53.9 117.0 63.0 34.2 0.3	1990 0 7.0 10.0 51.0 44.6 112.7 61.8 57.0	1991 0 6.8 8.8 50.4 27.8 95.1 55.0 68.0 7.0	0 6.4 8.0 39.5 23.4 89.3 41.9 63.8 42.0	0 6.2 7.3 28.0 20.1 81.5 34.5 61.5 65.0
8K 16K 32K 64K 128K 256K 512K 1Mb 2Mb	0 0 14.7 20.7 93.9 52.2 57.5 5.7 0.2 0	0 9.7 16.2 56.3 50.3 100.8 29.0 1.7	1988 0 0 8.6 13.9 58.8 55.8 115.3 55.0 8.7 0	1989 0 7.8 11.6 56.1 53.9 117.0 63.0 34.2 0.3 1.7	1990 0 7.0 10.0 51.0 44.6 112.7 61.8 57.0 1.3 6.2	1991 0 6.8 8.8 50.4 27.8 95.1 55.0 68.0 7.0 32.0	0 6.4 8.0 39.5 23.4 89.3 41.9 63.8 42.0 70.0	0 6.2 7.3 28.0 20.1 81.5 34.5 61.5 65.0
8K 16K 32K 64K 128K 256K 512K 1Mb 2Mb 4Mb	0 0 14.7 20.7 93.9 52.2 57.5 5.7 0.2 0	0 9.7 16.2 56.3 50.3 100.8 29.0 1.7 0	1988 0 0 8.6 13.9 58.8 55.8 115.3 55.0 8.7 0	1989 0 7.8 11.6 56.1 53.9 117.0 63.0 34.2 0.3 1.7	1990 0 7.0 10.0 51.0 44.6 112.7 61.8 57.0 1.3 6.2	1991 0 6.8 8.8 50.4 27.8 95.1 55.0 68.0 7.0 32.0	0 6.4 8.0 39.5 23.4 89.3 41.9 63.8 42.0 70.0	0 6.2 7.3 28.0 20.1 81.5 34.5 61.5 65.0 106.0

Table 4 (Continued)

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

	Average Selling Price (\$)								
	1986	<u> 1987</u>	1988	1989	<u>1990</u>	<u>1991</u>	<u>1992</u>	<u>1993</u>	
4K	0	0	0	o	. 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

Table 5
Worldwide NMOS UV EPROM Market

	Millions of Dollars										
	1986	1987	1988	1989	1990	<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			
8Мъ	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%)			
			Mi	llions	of Unit	·					
	1986	1987			of Unit 1990		1992	1993			
	1986	1987	<u>Mi</u> 1988	llions 1989	<u>of Unit</u> 1990	5 1991	1992	1993			
4K	<u>1986</u> 0	<u>1987</u> 0					0	1993 0			
4K 8K			<u>1988</u>	1989	1990	<u>1991</u>					
	0	0	1988 0 0 5.6	<u>1989</u> 0	<u>1990</u> 0	1991 0 0 2.4	0 0 1.9	0 0 1.7			
8K	0	0	<u>1988</u> 0 0	1989 0 0	1990 0 0	1991 0 0	0 0 1.9 5.0	0 0 1.7 4.3			
8K 16K	0 0 14.7	0 0 7.3	1988 0 0 5.6	1989 0 0 3.5	1990 0 0 2.9	1991 0 0 2.4	0 0 1.9	0 0 1.7			
8K 16K 32K	0 0 14.7 18.1	0 0 7.3 13.1	1988 0 0 5.6 11.9	1989 0 0 3.5 9.3	1990 0 0 2.9 7.0	1991 0 0 2.4 5.8	0 0 1.9 5.0	0 0 1.7 4.3			
8K 16K 32K 64K	0 0 14.7 18.1 77.6	0 7.3 13.1 40.6	1988 0 0 5.6 11.9 35.1	1989 0 0 3.5 9.3 22.1	1990 0 0 2.9 7.0 14.0	1991 0 0 2.4 5.8 11.1	0 0 1.9 5.0 8.5	0 0 1.7 4.3 5.4			
8K 16K 32K 64K 128K	0 0 14.7 18.1 77.6 50.3	0 7.3 13.1 40.6 39.5	1988 0 0 5.6 11.9 35.1 39.7	1989 0 0 3.5 9.3 22.1 33.8	1990 0 0 2.9 7.0 14.0 25.6	1991 0 0 2.4 5.8 11.1 13.7	0 0 1.9 5.0 8.5	0 0 1.7 4.3 5.4 7.6			
8K 16K 32K 64K 128K 256K	0 0 14.7 18.1 77.6 50.3 43.4	0 7.3 13.1 40.6 39.5 56.9	1988 0 0 5.6 11.9 35.1 39.7 51.7	1989 0 0 3.5 9.3 22.1 33.8 33.9	1990 0 0 2.9 7.0 14.0 25.6 25.0	1991 0 0 2.4 5.8 11.1 13.7 16.9	0 1.9 5.0 8.5 10.1 14.0	0 1.7 4.3 5.4 7.6			
8K 16K 32K 64K 128K 256K 512K	0 0 14.7 18.1 77.6 50.3 43.4 5.4	0 7.3 13.1 40.6 39.5 56.9 20.4	1988 0 0 5.6 11.9 35.1 39.7 51.7 34.3	1989 0 0 3.5 9.3 22.1 33.8 33.9 27.5	1990 0 0 2.9 7.0 14.0 25.6 25.0 20.5	1991 0 0 2.4 5.8 11.1 13.7 16.9	0 1.9 5.0 8.5 10.1 14.0	0 1.7 4.3 5.4 7.6 10.5 3.0			
8K 16K 32K 64K 128K 256K 512K 1Mb	0 14.7 18.1 77.6 50.3 43.4 5.4	0 7.3 13.1 40.6 39.5 56.9 20.4 0.3	1988 0 0 5.6 11.9 35.1 39.7 51.7 34.3 1.3	1989 0 0 3.5 9.3 22.1 33.8 33.9 27.5 5.2	1990 0 0 2.9 7.0 14.0 25.6 25.0 20.5 5.0	1991 0 0 2.4 5.8 11.1 13.7 16.9 14.4 2.8	0 0 1.9 5.0 8.5 10.1 14.0 7.4 2.0	0 1.7 4.3 5.4 7.6 10.5 3.0			
8K 16K 32K 64K 128K 256K 512K 1Mb 2Mb	0 0 14.7 18.1 77.6 50.3 43.4 5.4 0.1	0 7.3 13.1 40.6 39.5 56.9 20.4 0.3	1988 0 0 5.6 11.9 35.1 39.7 51.7 34.3 1.3	1989 0 0 3.5 9.3 22.1 33.8 33.9 27.5 5.2	1990 0 0 2.9 7.0 14.0 25.6 25.0 20.5 5.0	1991 0 0 2.4 5.8 11.1 13.7 16.9 14.4 2.8	0 0 1.9 5.0 8.5 10.1 14.0 7.4 2.0	0 1.7 4.3 5.4 7.6 10.5 3.0 1.7			
8K 16K 32K 64K 128K 256K 512K 1Mb 2Mb	0 0 14.7 18.1 77.6 50.3 43.4 5.4 0.1	0 7.3 13.1 40.6 39.5 56.9 20.4 0.3	1988 0 0 5.6 11.9 35.1 39.7 51.7 34.3 1.3 0	1989 0 0 3.5 9.3 22.1 33.8 33.9 27.5 5.2 0	1990 0 0 2.9 7.0 14.0 25.6 25.0 20.5 5.0	1991 0 0 2.4 5.8 11.1 13.7 16.9 14.4 2.8 0	0 0 1.9 5.0 8.5 10.1 14.0 7.4 2.0	0 0 1.7 4.3 5.4 7.6 10.5 3.0 1.7			
8K 16K 32K 64K 128K 256K 512K 1Mb 2Mb 4Mb	0 0 14.7 18.1 77.6 50.3 43.4 5.4 0.1 0	0 7.3 13.1 40.6 39.5 56.9 20.4 0.3 0	1988 0 0 5.6 11.9 35.1 39.7 51.7 34.3 1.3 0	1989 0 0 3.5 9.3 22.1 33.8 33.9 27.5 5.2 0	1990 0 0 2.9 7.0 14.0 25.6 25.0 20.5 5.0 0	1991 0 0 2.4 5.8 11.1 13.7 16.9 14.4 2.8 0	0 0 1.9 5.0 8.5 10.1 14.0 7.4 2.0 0	0 1.7 4.3 5.4 7.6 10.5 3.0 1.7 0			

Table 5 (Continued)
Worldwide NMOS UV EPROM Market

	Average Selling Price (\$)								
	<u>1986</u>	<u>1987</u>	1988	<u>1989</u>	1990	<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	\$ 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

Table 6
Worldwide CMOS UV EPROM Market

	Millions of Dollars									
	1986	198	<u>7 198</u>	8 <u>19</u>	<u>89</u>	990	1991		1992	1993
4K	0		0	0	0	0		0 .	0	0
8K	0			0	ŏ	Ö		0 .	ő	Ö
16K	ō			.6 \$	19 \$	17	\$ 1		19	\$ 19
32K	\$ 7		-	8	9	13	1:		13	13
64K	63	5			143	159	17		137	102
128K	7	4		3	89	82	б		60	57
256K	70	22			386	388	35		350	339
512K	4		5 16		234	228	19	9	169	165
1МЬ	9	3	8 14	3	413	576	58	0	470	446
2Mb	0		0	0	11	24	8	6	389	546
4Mb	0		0 1	.8	77	163	48	6	721	896
8Mb	0		<u> </u>	<u> </u>	0	0		<u>o</u> _	<u> </u>	<u>136</u>
Total	\$161	\$45	4 \$85	5 \$1,	382 \$1	,649	\$1,96	7 \$:	2,332	\$2,719
% Change from										
Previous Year	54%	181	% 88	%	62%	19%	19	%	19%	17%
	ĩ	986	1987	1988	Million 1989	1990		91	1992	1993
4K		0	0	0	O)	0	0	0	0
8K		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	1	6.3	15.8	23.7		37.	.0 3	9.3	31.0	22.6
128K		1.9	10.8	16.1				4.1	13.3	12.5
256K		4.1	43.9	63.6	83.1			8.2	75.3	71.0
512K		0.3	8.6	20.7				0.6	34.5	31.5
1Mb		0.1	1.4	7.5				5.2	61.8	59.8
2Mb		0	0	0	0.3			7.0	42.0	65.0
4Mb		0	0	0.2	1.7			2.0	70.0	106.0
8Mb	_	0	0	0	0	2	<u> </u>	. 0	0.1	4.0
Total	3	5.3	86.0	136.8	210.3	251	.6 28	3.8	335.5	379.9
% Change from Previous Year		76%	143%	59%	549	. 20)%	13%	18%	13%

Table 6 (Continued)

Worldwide CMOS UV EPROM Market

	Average Selling Price (\$)								
	<u> 1986</u>	1987	1988	1989	1990	<u>1991</u>	<u> 1992</u>	<u> 1993</u>	
4K ·	0	0	0	0	0	0	0	0	
8K	Ō	Ŏ	Ö	Ö	0	0	0	0	
16K	Ð	\$ 3.36	\$ 5.08	\$ 4.50	\$ 4.20	\$ 4.10	\$ 4.20	\$ 4.20	
32K	\$ 2.71	•	\$ 3.81	•	•	•	Ť.		
64K	\$ 3.87	•	\$ 4.10	•	•	1			
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

Table 7
Worldwide MOS OTP EPROM Market—Total (NMOS and CMOS)

	Millions of Dollars								
	<u>1986</u>	1987	1988	1989	1990	<u> 1991</u>	1992	<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	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	
2МЬ	0	0	0	0	1	29	58	111	
4Mb	0	0	0	0	17	<u>48</u>	<u>87</u>	<u>140</u>	
Total	\$72	\$151	\$142	\$188	\$227	\$305	\$359	\$435	
% Change from									
Previous Year	259%	111%	(6%)	32%	20%	35%	18%	21%	
					*				
				<u>illions</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	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	<u>11.0</u>	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%	

Table 7 (Continued)

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

	Average Selling Price (\$)							
	1986	<u>1987</u>	1988	1989	<u>1990</u>	<u>1991</u>	<u> 1992</u>	<u>1993</u>
4K	0	0	0	0	0	0	0	0
8K	0	Ò	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
2Мь	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

Table 8
Worldwide NMOS OTP EPROM Market

	Millions of Dollars								
	191	86	1987	1988	1989	<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	_	٠ .	0	0	0	0	_0	0	0
Total	\$0	61 8	\$105	\$76	\$80	\$45	\$29	\$19	\$16
% Change from									
Previous Year	260	5%	72%	(28)	5	(44)	(36)	(32)	(19)
				W: 11	ions of	: IInite			
	1986	198	7 1	988	1989	1990	1991	1992	1993
4K	N/A	N/A	A i	N/A	N/A	N/A	N/A	N/A	N/A
8K	N/A	N/X	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/		N/A	N/A	N/A	N/A	N/A	N/A
64K	4.9	7.		3.2	1.9	1.0	0.4	0	0
128K	5.2	6.4		4.5	2.3	1.2	0.4	0	0
256K	10.4	14.		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/Z		N/A	N/A	N/A	N/A	N/A	N/A
2Mb	N/A	N/2		N/A	N/A	N/A	N/A	N/A	N/A
4Mb	<u> N/A</u>	<u> </u>	<u> </u>	N/A	N/A	<u> N/A</u>	N/A	N/A	<u>n/a</u>
Total	21.4	31.	2 1	8.8	18.3	12.2	7.9	5.1	4.0

Table 8 (Continued)

Worldwide NMOS OTP EPROM Market

	Average Selling Price (\$)									
	1986	<u>1987</u>	1988	<u>1989</u>	1990	<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	\$ 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		
1Мь	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

Table 9
Worldwide CMOS OTP EPROM Market

	Millions of Dollars									
	1986	<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	<u>87</u>	<u>140</u>		
Total	\$11	\$46	\$67	\$109	\$182	\$276	\$339	\$420		
% Change from										
Previous Year	228%	330%	46%	63%	67%	52%	23%	24%		
			ve:	113	. # ****	_				
	1986	1007		llions			1002	1993		
	<u>1900</u>	<u>1987</u>	<u>1988</u>	<u>1989</u>	<u>1990</u>	<u>1991</u>	<u> 1992</u>	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	<u>n/a</u>	N/A	<u> </u>	0	0.8	4.0	<u>11.0</u>	<u>20.0</u>		
Total	2.9	14.8	15.6	21.7	30.1	42.6	56.4	71.5		

Table 9 (Continued)

Worldwide CMOS OTP EPROM Market

	Average Selling Price (\$)							
	<u>1986</u>	1987	1988	1989	1990	<u> 1991</u>	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

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

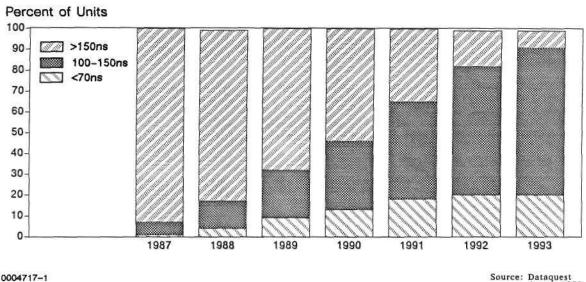
Although worldwide EPROM production and shipments grew 13 percent in 1988, strong demand and continued high ASPs were the greatest contributors to strong revenue growth in 1988. Although U.S. and European EPROM suppliers continued to benefit from MITI-imposed production reductions, EPROM users were forced 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,

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.

Figure 1 High-Speed EPROM Market Forecast



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

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.

Table 10
1989 2Mb/4Mb CMOS EPROM Suppliers

•	Fastest	2	Mb	4	мь_
Company	<u>Speed</u>	<u>x8</u>	<u>*16</u>	<u>x8</u>	<u> 116</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

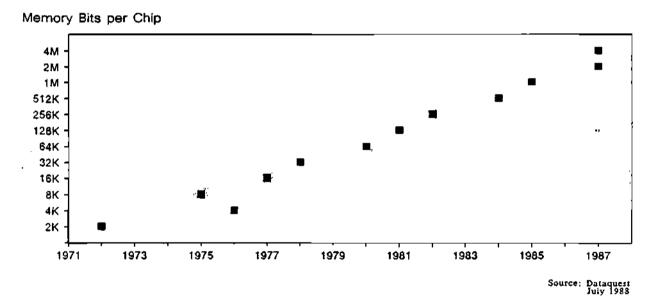
Source: Dataquest August 1989

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.

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 shute 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

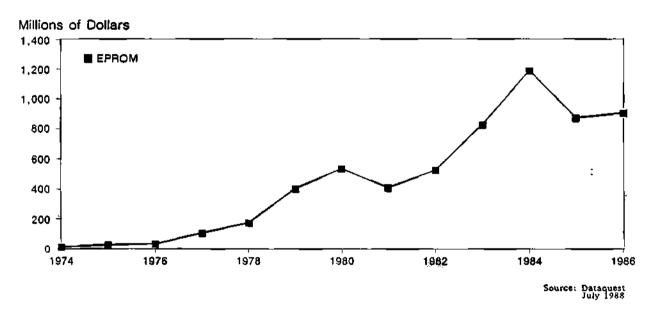


The pinnacle of EPROM development was reached in 1977, with Intel's introduction of the 16K EPROM. The 5-volt 16K device was to become not only the industry standard for EPROMS, but it was also compatible with microprocessor systems. In essence, the marrying of the EPROM and the microprocessor accelerated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



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

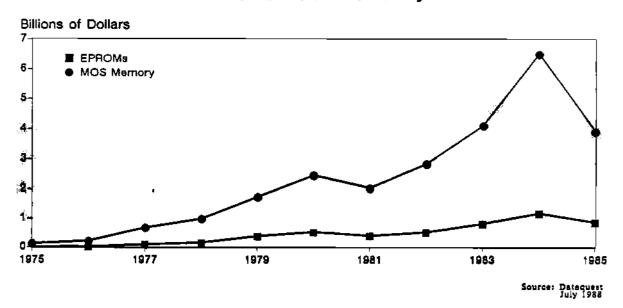
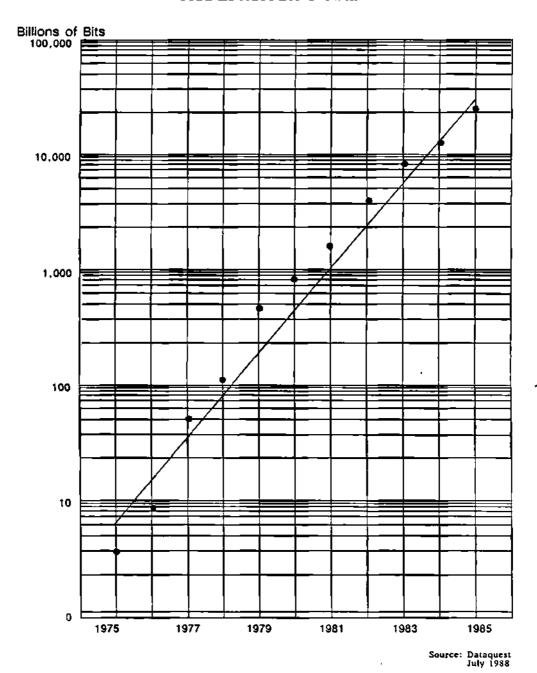
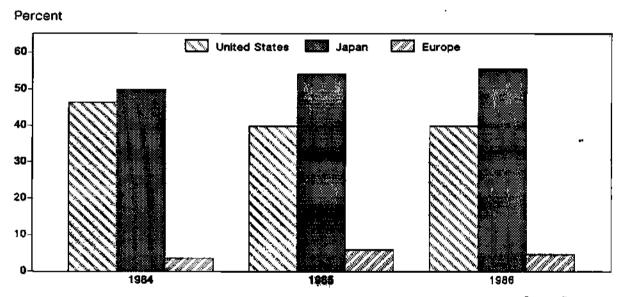


Figure 4 MOS EPROM Bit Growth



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

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

Table 1

MOS EPROMs—Total Worldwide Market

				Mil	lions	of	Doll:	ars				
	1985	<u>1986</u>	1987	19	988	19	989	1	990	1	991	<u>1992</u>
4K	0	0		0	0		0		0		0	0
8K	Ŏ	ō		Õ	Ō		Ō		ō		ō	ō
16K	\$ 64	\$ 35		8 \$	23	\$	18	\$	15	\$	12	\$ 11
32K	101	48		6	35	,	19		10		6	3
64K	294	266	21	.9	227		195		160		125	105
128K	226	163	20	1	211		191		144		116	98
256K	177	320	55	5	651		642		542		493	423
512K	15	68	25	5	372		348		330		291	245
1M	0	12	4	.3	259		493		707		819	835
2M	0	0		0	4		25		72		253	419
4M	0	0		0	0		1		12		58	308
. М8	0	0		0	0		0	_	0	_	0	5
Total	\$876	\$913	\$1,34	17 \$1,	,783	\$1,	, 933	\$1	,992	\$2	2,172	\$2,451
% Change from												
Previous Year	(26%)	4%	48	3%	32%		8%		3%		9%	13%
				,	willi	ons	of U	nit	s		=	÷
	<u>ī</u>	<u>985</u>	<u> 1986</u>	1987		88	198		1990		1991	1992
4K		0	0		0	0		0		0	0	0
8K		Ŏ	0		Ď	ō		0		Ö	Ö	Ō
16K		24.6	14.7	9.		6.8	4	.9	3.		3.1	2.6
32K		38.6	21.6	16.4		9.9		.0	2.4		1.5	0.8
64K		03.0	99.6	73.2		3.0	50		39.0		30.0	25.0
128K		56.1	57.3	57.1		7.0	51		38.6		30.0	25.0
256K		22.2	70.0	119.9		0.0	137		126.0		116.0	102.0
512K		0.5	5.7	30.9		1.0	67		64.0		57.0	49.0
1M		0	0.2	1.6		6.0	44		79.		107.0	121.0
2M		ō	0)	0		.4	2.0		11.0	26.0
4M		Ō	0)	0	_	0	0.2		1.7	15.0
8M	_	0	0			0		0		2	0	0
Total	2	45.0	269.1	309.5	5 35	3.8	359	. 8	354.	4	357.3	366.4
% Change from Previous Year		11%	10%	159	b	14%	:	2%	(29	&)	1%	3%
											(Cont	inued)

Table 1 (Continued)

MOS EPROMs—Total Worldwide Market

	Average Selling Price (\$)													
	•	<u> 1985</u>		1986		<u> 1987</u>		<u> 1988</u>	3	1989	1990		1991	<u> 1992</u>
4K		Ô		0		0		0		°0°	Ó		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		G	\$:	125.00	\$ 62.00	\$3	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

Table 2 Worldwide NMOS EPROM Market-Total (UV and OTP)

			Mil	lions o	f Dolla	rs		
	1985	1986	<u> 1987</u>	1988	<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	Ö	Ö	0	Ŏ	Ö
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	Ō	Ō	Ō	0	0	0	0	0
4M ·	ō	0	Ó	Ó	Ó	o	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%)
					, — - · ,		, ,	,
							-	
	1005	1006		llions			1007	1000
	<u>1985</u>	<u>1986</u>	<u>1987</u>	1988	<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	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%)
							(Cont	inued)

Table 2 (Continued) Worldwide NMOS EPROM Market—Total (UV and OTP)

			Avera	ge Sell	ing Pric	e (\$)		
	1985	1986	<u> 1987</u>	1988	1989	1990	<u>1991</u>	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
IM	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

Table 3 Worldwide CMOS EPROM Market—Total (UV and OTP)

					Mil	lions	of [011	ars			
	1985	<u>198</u>	6	198		1988		89	199	Q	<u>1991</u>	1992
4K	0	0		0		0	0		0		0	0
8K	0	0		0		0	0		0		0	0
16K	\$11	0	\$	8	\$ 1		10	\$	11	\$	9	\$ 8
32K		\$ 7		10		9	6		3		2	2
64K	22	65		93	12	3	122		110		102	100
128K	4	7		41	6	8	71		63		59	60
256K	30	80	2	35	32	6	375		373		388	378
512K	0	4		78	14	9	166		170		178	185
1M	0	9		36	22	5	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		<u> </u>	0		0	_	0	5
Total	\$85	\$173	\$5	00	\$91	5 \$1	,221	\$1	,452	\$	1,804	\$2,230
% Change from												
Previous Year		105%	18	9%	83	٠,	33%		19%		24%	24%
			_		M	illio	ns of	Un	its			
	198	5 19	86	198		1988	198		1990		<u>1991</u>	1992
4K	(0	0		0	0	1	0		0	0	0
8K	(0	0		0	0	ı	0		0	0	0
16K	3.0	0	0	2.	. 4	3.3	. 2	.7	2.	7	2.1	2.0
32K	4.	5 2	2.7	3.	. 1	2.5	;]	4	0.	7	0.5	0.4
64K	5.	5 17	1.1	25.	. З	31.5	29	0.0	25.	0	22.5	21.3
128K	0.		. 9	10.	. 8	17.1	. 17	7.9	16.	0	14.7	14.0
256K	3.		5.2	48.		68.6		8.0	81.		83.5	79.6
512K			.3	8.		22.6		8.0	32.		35.3	38.2
1M			1.0	1.	. 3	13.6		3.7	71.		100.6	116.2
2M		0	0		0	0		.4	2.		11.0	26.0
4M		0	0		0	0		0	0.		1.7	15.0
8M		<u> </u>	_0	_	0		<u> </u>	_0		0	0	0
Total	16.	7 38	3.3	99.	. 8	159.1	. 200).6	232.	2	272.0	312.6
% Change from												
Previous Year		12	9%	161	L%	599	. 2	26%	16	ъ	17%	15%
											(Cont	tinued)

Table 3 (Continued) Worldwide CMOS EPROM Market—Total (UV and OTP)

	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	\$ 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

Table 4 Worldwide MOS UV EPROM Market—Total (NMOS and CMOS)

				Milli	ons of	Dollar	rs.		
	1985	1986	1987			989	1990	1991	1992
4K	0	0		0	0	0	0	0	0
8K	0	0		0	0	0	0	0	0
16K	\$ 64	\$ 35		8 \$	23 \$	18 8	15	\$ 12	\$ 11
32K	96	46	4	6	35	21	10	6	3
64K	284	257	21	0 2	206	180	152	125	113
128K	223	150	17	6 1	.84	155	118	95	92
256K	174	272	47	6 9	570	564	493	481	439
512K	14	68	24	2 3	343	305	270	230	196
1M	0	12	4	3 2	42	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		<u> </u>		0	0	0	5
Total	\$856	\$841	\$1,22	1 \$1,6	506 \$1	,711 :	\$1,713	\$1,861	\$2,144
% Change from									
Previous Year		(2%)	45	% 3	12%	7%	0%	9%	15%
	,	985			llions	of Uni			
			1026	1027	1088	1020	7000	1001	1002
	_	905	<u>1986</u>	<u> 1987</u>	<u>1988</u>	<u>1989</u>	<u>1990</u>	<u>1991</u>	<u>1992</u>
4K	-	0	<u>1986</u> 0	<u>1987</u> 0	<u>1988</u> 0	<u>1989</u>			<u>1992</u> 0
4K 8K	-) (0 0	
		0	0	0	0	() (0 0	0
8K		0	0	0	0	() () () 3.8	0 0 0 0 3.1	0 0
8K 16K		0 0 24.6 35.6 99.0	0 0 14.7	0 0 9.8	0 0 6.8	4.9) () () 3.8	0 0 0 0 3 3.1 1 1.5	0 0 2.6
8K 16K 32K 64K 128K		0 0 24.6 35.6	0 0 14.7 20.7	0 0 9.8 16.4	0 0 6.8 9.9	4.9 5.4) () () 3.8 1 2.6) 35.0	0 0 0 0 3 3.1 4 1.5 0 28.0	0 0 2.6 0.8
8K 16K 32K 64K 128K 256K		0 0 24.6 35.6 99.0	0 0 14.7 20.7 93.9 52.2 57.5	0 9.8 16.4 63.8	0 6.8 9.9 55.0	4.9 5.4 44.0) () 3.6 4 2.6) 35.6) 30.6	0 0 0 0 3 3.1 4 1.5 0 28.0 0 24.0 0 98.0	0 2.6 0.8 24.5
8K 16K 32K 64K 128K 256K 512K		0 0 24.6 35.6 99.0 55.3	0 0 14.7 20.7 93.9 52.2	0 9.8 16.4 63.8 49.1	0 6.8 9.9 55.0 48.0 121.0 54.0	4.9 5.4 44.0 40.0	3 (0) (0) (0) (0) (0) (0) (0) (0) (0) (0)	0 0 0 0 3 3.1 4 1.5 0 28.0 0 24.0 0 98.0	0 2.6 0.8 24.5 22.0
8K 16K 32K 64K 128K 256K 512K		0 0 24.6 35.6 99.0 55.3 21.7	0 0 14.7 20.7 93.9 52.2 57.5	0 9.8 16.4 63.8 49.1	0 6.8 9.9 55.0 48.0	4.9 5.4 44.0 40.0	3 (0) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1	0 0 0 0 3 3.1 4 1.5 0 28.0 24.0 98.0 0 44.2	0 2.6 0.8 24.5 22.0 86.0
8K 16K 32K 64K 128K 256K 512K		0 0 24.6 35.6 99.0 55.3 21.7 4	0 0 14.7 20.7 93.9 52.2 57.5 5.7	0 9.8 16.4 63.8 49.1 102.1 29.1	0 6.8 9.9 55.0 48.0 121.0 54.0	4.9 5.4 44.0 40.0 116.0	30 (0) 3.8 30 (0) 35.0 30.0 103.0 51.0 61.0	0 0 0 3.1 1.5 28.0 24.0 98.0 98.0 44.2 72.0	0 2.6 0.8 24.5 22.0 86.0 38.0
8K 16K 32K 64K 128K 256K 512K 1M 2M		0 0 24.6 35.6 99.0 55.3 21.7 4 0	0 0 14.7 20.7 93.9 52.2 57.5 5.7 2 0	0 9.8 16.4 63.8 49.1 102.1 29.1	0 6.8 9.9 55.0 48.0 121.0 54.0	44.0 44.0 40.0 116.0 56.0	3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3	0 0 0 0 3.1 1.5 28.0 24.0 98.0 44.2 72.0 11.0	0 2.6 0.8 24.5 22.0 86.0 38.0 76.0
8K 16K 32K 64K 128K 256K 512K		0 0 24.6 35.6 99.0 55.3 21.7 4	0 0 14.7 20.7 93.9 52.2 57.5 5.7 2	0 9.8 16.4 63.8 49.1 102.1 29.1 1.6	0 6.8 9.9 55.0 48.0 121.0 54.0 14.0	44.0 44.0 40.0 116.0 56.0	3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3	0 0 0 0 3.1 1.5 28.0 24.0 98.0 44.2 72.0 11.0 1.7	0 2.6 0.8 24.5 22.0 86.0 38.0 76.0 26.0
8K 16K 32K 64K 128K 256K 512K 1M 2M		0 0 24.6 35.6 99.0 55.3 21.7 4 0 0	0 0 14.7 20.7 93.9 52.2 57.5 5.7 2 0	0 9.8 16.4 63.8 49.1 102.1 29.1 1.6 0	0 6.8 9.9 55.0 48.0 121.0 54.0 0 0	44.0 44.0 40.0 116.0 38.0	3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3	0 0 0 0 3.1 1.5 28.0 24.0 98.0 44.2 72.0 11.0 1.7	0 0.8 24.5 22.0 86.0 38.0 76.0 26.0 15.0
8K 16K 32K 64K 128K 256K 512K 1M 2M 4M 8M		0 0 24.6 35.6 99.0 55.3 21.7 4 0 0	0 0 14.7 20.7 93.9 52.2 57.5 5.7 2 0	0 9.8 16.4 63.8 49.1 102.1 29.1 1.6 0	0 6.8 9.9 55.0 48.0 121.0 54.0 0 0	44.0 44.0 40.0 116.0 38.0	3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3	0 0 0 0 3 3.1 4 1.5 28.0 24.0 98.0 44.2 72.0 11.0 2 1.7	0 0.8 0.8 24.5 22.0 86.0 38.0 76.0 26.0 15.0
8K 16K 32K 64K 128K 256K 512K 1M 2M 4M		0 0 24.6 35.6 99.0 55.3 21.7 4 0 0	0 0 14.7 20.7 93.9 52.2 57.5 5.7 2 0	0 9.8 16.4 63.8 49.1 102.1 29.1 1.6 0	0 6.8 9.9 55.0 48.0 121.0 54.0 14.0 0	44.0 44.0 40.0 116.0 38.0	3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3	0 0 0 0 3.1 1.5 28.0 24.0 98.0 44.2 72.0 11.0 1.7 0 283.5	0 0.8 0.8 24.5 22.0 86.0 38.0 76.0 26.0 15.0

(Continued)

Table 4 (Continued) Worldwide MOS UV EPROM Market—Total (NMOS and CMOS)

			Aver	age Sell:	ing Pric	e (\$)		
	<u>1985</u>	<u>1986</u>	<u>1987</u>	<u>1988</u>	<u>1989</u>	<u>1990</u>	<u>1991</u>	1992
4K	0	0	0	O.	0	Ö	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

Table 5 Worldwide NMOS UV Market

			Mi	llions	of Dolla	ars		_
	. <u>1985</u>	1986	<u>1987</u>	<u>1988</u>	1989	1990	<u>1991</u>	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%	s) 9%	(1%)	(25%)	(30%)	(37%)	(49%)
	1005	1006			of Unit		1001	1002
	1985	<u>1986</u>	<u>мі</u> 1987	<u>llions</u> 1988	of Unit 1989	<u>s</u> 1990	1991	1992
4K	1985 0	<u>1986</u> 0						<u>1992</u> 0
4K 8K		-	1987	1988	1989	<u>1990</u>	1991	
8K 16K	0 0 21.6	0	1987 0 0 7.4	<u>1988</u> 0	1989 0 0 2.2	1990 0 0 1.1	1991 0	0
8K 16K 32K	0 0 21.6 31.1	0	1987 0 0	1988 0 0	<u>1989</u> 0 0	1990 0 0	1991 0 0 1.0 1.0	0
8K 16K 32K 64K	0 0 21.6 31.1 94.5	0 0 14.7	1987 0 0 7.4	1988 0 0 3.5	1989 0 0 2.2	1990 0 0 1.1	1991 0 0 1.0	0 0 0.6
8K 16K 32K 64K 128K	0 0 21.6 31.1 94.5 54.8	0 0 14.7 18.1 77.6 50.3	1987 0 0 7.4 13.3 39.9 38.7	1988 0 0 3.5 7.4 24.6 31.4	1989 0 0 2.2 4.0	1990 0 0 1.1 1.7 10.4 14.4	1991 0 0 1.0 1.0 5.7 9.6	0 0 0.6 0.4
8K 16K 32K 64K 128K 256K	0 21.6 31.1 94.5 54.8 18.5	0 0 14.7 18.1 77.6 50.3 43.4	1987 0 0 7.4 13.3 39.9 38.7 57.1	1988 0 0 3.5 7.4 24.6 31.4 55.6	1989 0 0 2.2 4.0 15.6 22.7 39.5	1990 0 0 1.1 1.7 10.4 14.4 23.4	1991 0 0 1.0 1.0 5.7 9.6 16.3	0 0.6 0.4 3.3 8.2 8.0
8K 16K 32K 64K 128K 256K	0 0 21.6 31.1 94.5 54.8 18.5 0.4	0 0 14.7 18.1 77.6 50.3 43.4 5.4	1987 0 0 7.4 13.3 39.9 38.7 57.1 20.2	1988 0 0 3.5 7.4 24.6 31.4 55.6 31.6	1989 0 0 2.2 4.0 15.6 22.7 39.5 25.5	1990 0 0 1.1 1.7 10.4 14.4 23.4 18.8	1991 0 0 1.0 1.0 5.7 9.6 16.3 9.2	0 0.6 0.4 3.3 8.2 8.0
8K 16K 32K 64K 128K 256K 512K	0 0 21.6 31.1 94.5 54.8 18.5 0.4	0 0 14.7 18.1 77.6 50.3 43.4	1987 0 0 7.4 13.3 39.9 38.7 57.1 20.2 0.3	1988 0 0 3.5 7.4 24.6 31.4 55.6 31.6 2.4	1989 0 0 2.2 4.0 15.6 22.7 39.5 25.5 5.3	1990 0 0 1.1 1.7 10.4 14.4 23.4 18.8 7.9	1991 0 0 1.0 1.0 5.7 9.6 16.3 9.2 6.4	0 0.6 0.4 3.3 8.2 8.0 0.1 4.8
8K 16K 32K 64K 128K 256K 512K 1M	0 0 21.6 31.1 94.5 54.8 18.5 0.4	0 0 14.7 18.1 77.6 50.3 43.4 5.4	1987 0 0 7.4 13.3 39.9 38.7 57.1 20.2	1988 0 0 3.5 7.4 24.6 31.4 55.6 31.6	1989 0 0 2.2 4.0 15.6 22.7 39.5 25.5	1990 0 0 1.1 1.7 10.4 14.4 23.4 18.8 7.9	1991 0 0 1.0 1.0 5.7 9.6 16.3 9.2	0 0.6 0.4 3.3 8.2 8.0
8K 16K 32K 64K 128K 256K 512K 1M 2M	0 0 21.6 31.1 94.5 54.8 18.5 0.4	0 0 14.7 18.1 77.6 50.3 43.4 5.4 0.1	1987 0 0 7.4 13.3 39.9 38.7 57.1 20.2 0.3 0	1988 0 0 3.5 7.4 24.6 31.4 55.6 31.6 2.4 0	1989 0 0 2.2 4.0 15.6 22.7 39.5 25.5 5.3	1990 0 0 1.1 1.7 10.4 14.4 23.4 18.8 7.9 0	1991 0 0 1.0 5.7 9.6 16.3 9.2 6.4 0	0 0.6 0.4 3.3 8.2 8.0 0.1 4.8
8K 16K 32K 64K 128K 256K 512K 1M	0 0 21.6 31.1 94.5 54.8 18.5 0.4 0	0 0 14.7 18.1 77.6 50.3 43.4 5.4 0.1	1987 0 0 7.4 13.3 39.9 38.7 57.1 20.2 0.3 0	1988 0 0 3.5 7.4 24.6 31.4 55.6 31.6 2.4	1989 0 0 2.2 4.0 15.6 22.7 39.5 25.5 5.3 0	1990 0 0 1.1 1.7 10.4 14.4 23.4 18.8 7.9	1991 0 0 1.0 1.0 5.7 9.6 16.3 9.2 6.4 0	0 0.6 0.4 3.3 8.2 8.0 0.1 4.8
8K 16K 32K 64K 128K 256K 512K 1M 2M	0 0 21.6 31.1 94.5 54.8 18.5 0.4 0	0 0 14.7 18.1 77.6 50.3 43.4 5.4 0.1	1987 0 0 7.4 13.3 39.9 38.7 57.1 20.2 0.3 0	1988 0 0 3.5 7.4 24.6 31.4 55.6 31.6 2.4 0	1989 0 0 2.2 4.0 15.6 22.7 39.5 25.5 5.3 0	1990 0 0 1.1 1.7 10.4 14.4 23.4 18.8 7.9 0	1991 0 0 1.0 1.0 5.7 9.6 16.3 9.2 6.4 0 0	0 0.6 0.4 3.3 8.2 8.0 0.1 4.8
8K 16K 32K 64K 128K 256K 512K 1M 2M 4M 8M	0 0 21.6 31.1 94.5 54.8 18.5 0.4 0	0 0 14.7 18.1 77.6 50.3 43.4 5.4 0.1	1987 0 0 7.4 13.3 39.9 38.7 57.1 20.2 0.3 0	1988 0 0 3.5 7.4 24.6 31.4 55.6 31.6 2.4 0	1989 0 0 2.2 4.0 15.6 22.7 39.5 25.5 5.3 0 0	1990 0 0 1.1 1.7 10.4 14.4 23.4 18.8 7.9 0	1991 0 0 1.0 1.0 5.7 9.6 16.3 9.2 6.4 0 0	0 0.6 0.4 3.3 8.2 8.0 0.1 4.8 0
8K 16K 32K 64K 128K 256K 512K 1M 2M 4M 8M	0 0 21.6 31.1 94.5 54.8 18.5 0.4 0	0 0 14.7 18.1 77.6 50.3 43.4 5.4 0.1 0	1987 0 0 7.4 13.3 39.9 38.7 57.1 20.2 0.3 0 0	1988 0 0 3.5 7.4 24.6 31.4 55.6 31.6 2.4 0 0	1989 0 0 2.2 4.0 15.6 22.7 39.5 25.5 5.3 0 0	1990 0 0 1.1 1.7 10.4 14.4 23.4 18.8 7.9 0 0 77.7	1991 0 0 1.0 1.0 5.7 9.6 16.3 9.2 6.4 0 0 0	0 0.6 0.4 3.3 8.2 8.0 0.1 4.8 0

Table 5 (Continued)
Worldwide NMOS UV Market

			Avera	<u>ge Selli</u>	ng Price	(\$)		
	<u>1985</u>	<u>1986</u>	<u>1987</u>	1988	<u>1989</u>	<u>1990</u>	<u>1991</u>	<u>1992</u>
4K	0	0	0	0	0	0	o	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

Table 6 Worldwide CMOS UV EPROM Market

				V: 1	14	f D	.11-			
	1985	19	86 19			of Do 1989		990	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	б		3	2	2
64K	19	(90 1	.18	119		109	101	100
128K	4		7	40	67	69		61	57	60
256K	30	•	70 2	22 3	17	382		388	407	402
512K	0		4	77]	.47	169		173	182	195
1M	0		9	36 2	102	382		502	538	516
2M	0		0	0	4	25		71	264	426
4M '	0		0	0	0	1		12	60	308
8M	0	_	<u> </u>	<u> </u>	<u> </u>	0		0	0	5
Total	\$82	\$1	62 \$4	82 \$8	375	\$1,163	\$1	,329	\$1,620	\$2,022
% Change from										
Previous Year		9	8% 19	8% 8	32%	33%		14%	22%	25%
₹:					Mill.	ions o	F IIn	its		•
	19	98 <u>5</u>	<u>1986</u>	1987	198			1990	1991	1992
4K		0	0	0		0	0	O	0	0
8K		0	0	0		0	0	0	0	0
16K	3	1.0	0	2.4	3	.3	2.7	2.7	2.1	2.0
32K	4	1.5	2.7	3.1	2	.5	L.4	0.7	0.5	0.4
64K	4	1.5	16.3	23.9	30		8.4	24.6	22.3	21.2
128K	C	1.5	1.9	10.4	16		7.3	15.6	14.4	13.9
256K	3	3.2	14.1	45.0	65		5.5	79.6	81.7	78.0
512K		0	0.3	8.9	22.).5	32.3		37.9
1M		0	0.1	1.3	11.		2.7	53.1		71.2
2M		0	0	0		0 (1.4	2.0	11.0	26.0
4M		0	0	0		0	0	0.2		15.0

125% 168%

11% 11% 13%

(Continued)

8M

Total

% Change from Previous Year _0 _

60%

15.7 35.4 95.0 152.1 189.9 210.7 234.3 265.5

25%

Table 6 (Continued)

Worldwide CMOS UV EPROM Market

			Ave	rage <u>Sel</u>	ling Pri	ce (\$)		
	<u> 1985</u>	<u>1986</u>	<u> 1987</u>	1988	<u> 1989</u>	<u>1990</u>	<u> 1991</u>	<u>1992</u>
4K	0	0	0	o	Q	0	Q	ä
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	Ö	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

Table 7 Total MOS OTP EPROM Market—Total (NMOS and CMOS)

			Mi	llions (of Dolla	ars			
	1985	1986	1987	1988	1989	1990	<u>1991</u>	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	<u>1987</u>	<u> 1988</u>	<u>1989</u>	1990	<u>1991</u>	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	<u>Q</u>	0	
. Total	8.3	24.2	37.7	45.0	55.5	66.0	73.8	75.5	

(Continued)

Table 7 (Continued) Total MOS OTP EPROM Market—Total (NMOS and CMOS)

	Average Selling Price (\$)									
	<u>1985</u>	<u>1986</u>	1987	<u>1988</u>	1989	<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

Table 8
Worldwide NMOS OTP EPROM Market

			Mil	lions o	f Dolla	rs		
	1985	1986	1987	1988	1989	1990	1991	1992
4K	0	0	0	0	0	0	0	0
8K	Ŏ	ŏ	ō	Ŏ	ŏ	ŏ	ō	ŏ
16K	ŏ	ŏ	Ö	ŏ	ŏ	Ö	Ö	ŏ
32K	\$ 5	\$ 1	Ö	ŏ	ŏ	ŏ	Ö	ŏ
64K	7	10	\$ 19	\$ 20	\$ 15	\$ 11	\$ 6	\$ 2
128K	3	12	24	26	33	24	18	ğ
256K	3	38	53	57	67	71	55	48
512K	ō	0	13	34	43	49	47	40
1M	0	0	0	0	Ó	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%)
		_	×	(illions	of Uni	.ts		
	1985	<u> 1986</u>	1987	1988	<u>1989</u>	1990	<u>1991</u>	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
ım	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	<u> N/A</u>	<u> N/A</u>	<u>N/A</u>	N/A	N/A	<u>_N/A</u>	<u> </u>
Total	7.3	21.4	32.8	38.0	44.8	44.5	36.1	28.4

N/A = Not Available

(Continued)

Table 8 (Continued) Worldwide NMOS OTP EPROM Market

	Average Selling Price (\$)							
	<u>1985</u>	<u>1986</u>	<u>1987</u>	<u>1988</u>	1989	<u>1990</u>	<u>1991</u>	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
IM	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

Table 9 Worldwide CMOS OTP EPROM Market

	Millions of Dollars									
	1985	1986	1987	1988	1989	<u>1990</u>	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	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	_0	0	0	0	0	0	0	0		
Total	\$3	\$11	\$18	\$40	\$63	\$123	\$184	\$208		
% Change from										
Previous Year	-	228%	67%	124%	58%	96%	49%	13%		
	Millions of Units									
	1985	1986	1987	1988	1989	1990	<u>1991</u>	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	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>	N/A	<u>N/A</u>	<u> N/A</u>	<u> N/A</u>	N/A	<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)

Table 9 (Continued)

Worldwide CMOS OTP EPROM Market

			Averac	<u>re Sellir</u>	<u>ig Price</u>	(\$)		
	<u>1985</u>	<u>1986</u>	<u> 1987</u>	1988	<u>1989</u>	1990	<u>1991</u>	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

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.

Market Outlook

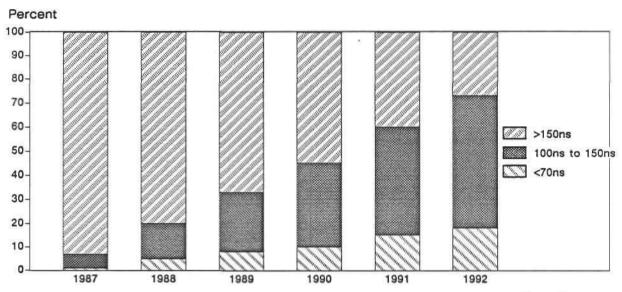
Although the second quarter of 1987 saw EPROM prices firming, pushing revenue out of the depressed price market of 1986, a large portion of the 1987 EPROM revenue growth can be attributed to trade agreement pressures. As a result of further U.S.-Japan trade agreement discussions, MITI introduced production 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.

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.

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 Typical erase time is I 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.

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.

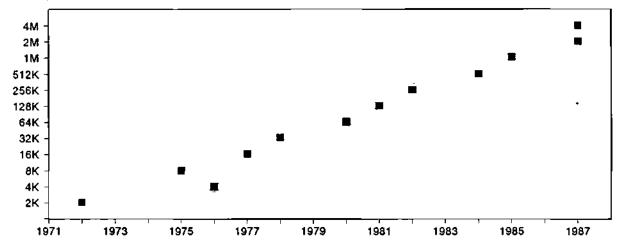
We believe that Toshiba's announcement of its 120ns 4-Mbit EPROM, along with the high-speed CMOS developments in 1987 and the innovative Flash memory announcements of 1987 and early 1988, were precursors of strong growth for the EPROM market. At present, the EPROM market is a commodity market fraught 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.

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 shute 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





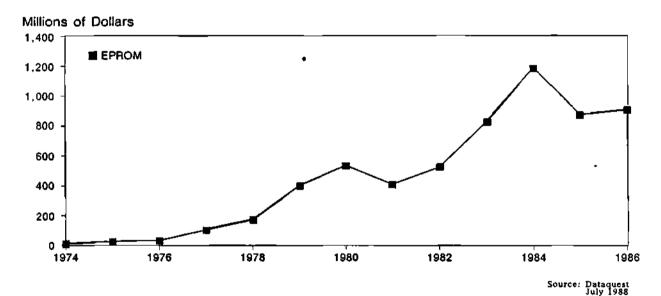
Source: Dataquest July 1988

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



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

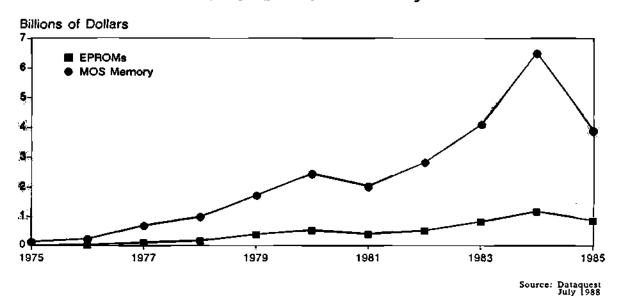
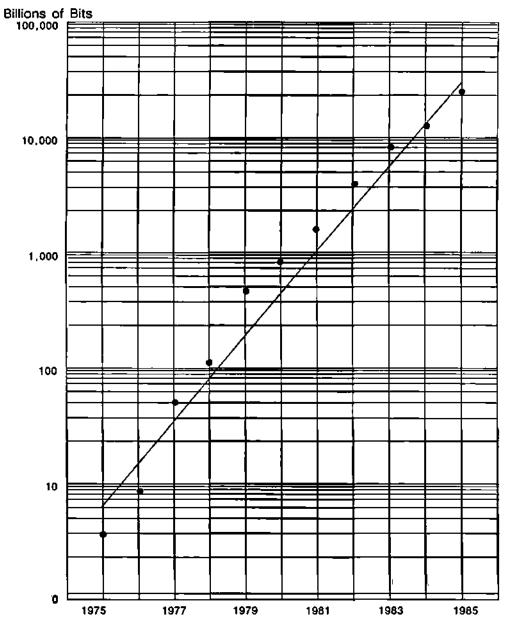


Figure 4

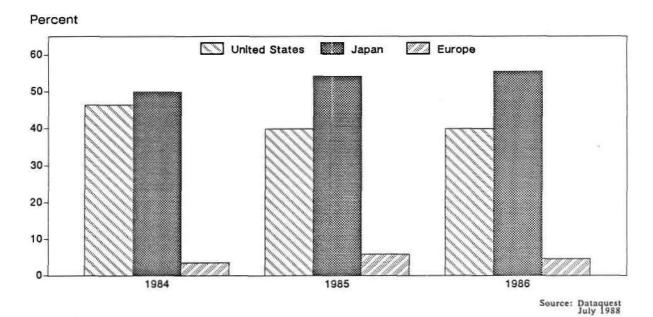
MOS EPROM Bit Growth



Source: Dataquest July 1988

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



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

Table 1

MOS EPROMs—Total Worldwide Market

				_ Mill	ions_o	f Doll	<u>a</u> rs			
	<u>1985</u>	<u> 1986</u>	1987			<u> 1989</u>		990	1991	<u>1992</u>
4K	0	0		0	0	0		0.	0	0
8K	0	0		0	0	0		0	0	0
16K	\$ 54	\$ 35		8 \$	23 \$		\$	15	\$ 12	\$ 11
32K	101	48	4	16	35	19		10	6	3
64K	294	266	21		227	195		160	125	105
128K	226	163	20		211	191		144	116	98
256K	177	320	55		651	642		542	493	423
512K	15	68	25		372	348		330	291	245
1M	0	12	4	13	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	5
Total	\$876	\$913	\$1,34	17 \$1,	783 \$	1,933	\$1	,992	\$2,172	\$2,451
% Change from										
Previous Year	(26%)	4%	48	3%	32%	8%		3%	9%	13%
	_ <u>1</u>	<u>.985</u>	1986	M 1987	illi <u>on</u> 1988	s of U		s 1990	1991	1992
4K		0	0	0		0	0	C	0	0
8K		0	0	0		0	0	C	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 ·	1	03.0	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
8М	-	0	0	0		<u> </u>	_0		0	0
Total	2	45.0	269.1	309.5	353.	8 359	. 8	354.4	357.3	366.4
% Change from						_				
Previous Year		11%	10%	15%	14	%	2%	(29	6) 1%	3%
									(Con	tinued)

SIS Memories 0000586

Table 1 (Continued)

MOS EPROMs—Total Worldwide Market

	Average Selling Price (\$)														
]	<u> 1985</u>	2	<u> 1986</u>		<u> 1987</u>		1988		1989	:	<u> 1990</u>	1991	;	<u> 1992</u>
472		· 6		6		0		o		.O:		æ.	Ö		0
4K		0		_		_		_		_		9			
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
ım	\$.	L25.00	\$	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

Table 2
Worldwide NMOS EPROM Market—Total (UV and OTP)

	Millions of Dollars										
	<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	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%)			
							©.				
				llions			_				
	<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	0	0	0	0	0	0	0	<u> </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%)			
							(Cont	inued)			

Table 2 (Continued)
Worldwide NMOS EPROM Market—Total (UV and OTP)

•	Average Selling Price (\$)							
	1985	<u>1986</u>	1987	1988	<u>1989</u>	1990	<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	\$ 2.50	\$ 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
256X	\$ 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

Table 3
Worldwide CMOS EPROM Market—Total (UV and OTP)

	Millions of Dollars											
	1985	19	<u>86</u>	198		1988		89	1990	0	1991	1992
4K	0	0		0		0	0		0		0	0
8K	0	0		0		0	0		0		0	0
16K	\$11	0	\$	8	\$ 1	1 \$	10	\$	11	\$	9	\$ 8
32K	18	\$ 7		10		9	6		3		2	2
64K	22	65		93	12	3	122		110		102	100
128K	4	7		41	6		71		63		59	60
256K	30	80	2	235	32		375		373		388	378
512K	0	4		78	14		166		170		178	185
IM	0	9		36	22		445		638		742	765
2M	0	0		0		4	25		72		264	419
4M	0	0		0		Đ	1,		12		60	308
8M.	0	0	_	0		<u> </u>	0	_	0		0	5
Total	\$85	\$173	\$5	500	\$91	5 \$1	,221	\$1	,452	\$1,	804	\$2,230
% Change from												
Previous Year		105%	18	39%	83	%	33%		19%		24%	24%
												:
					М	illio	ns of	Un	its			
	198	5 1	<u>986</u>	198		<u> 1988</u>	198		<u>1990</u>	1	<u>1991</u>	1992
4K		0	0		0	0		0	(0	0	0
8K		0	0		0	0		0	(0	0	0
16K	3.		0	2.		3.3		.7	2.1		2.1	2.0
32K	4.		2.7	3.		2.5		. 4	0.7		0.5	0.4
64K	5.		7.1	25.		31.5		.0	25.0		22.5	21.3
128K	0.		1.9	10.		17.1		.9	16.0		14.7	14.0
256K	3.		6.2	48.		68.6		.8	81.		83.5	79.6
512K			0.3	8.		22.6		.8	32.		35.3	38.2
1M			0.1	I.		13.6		.7	71.		100.6	116.2
2M		0	0		0	0	O	.4	2.0		11.0	26.0
4M		0	0		0	0		0	0.		1.7	15.0
8M		Q _	0		0	0		0		<u>o</u> _	0	0
Total	16.	7 3	8.3	99.	8	159.1	200	.6	232.	2 2	272.0	312.6
% Change from												
Previous Year		1:	29%	161	.%	59%	2	6%	16	%	17%	15%
											(Cont	tinued)

Table 3 (Continued)
Worldwide CMOS EPROM Market—Total (UV and OTP)

	<u> </u>							
	1985	<u>1986</u>	<u>1987</u>	1988	<u>1989</u>	1990	<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	\$ 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

Table 4
Worldwide MOS UV EPROM Market—Total (NMOS and CMOS)

	Millions of Dollars										
	1985	1986	1987		988		89		990	1991	1992
4K	0	0		0	0		0		0	0	0
8K	0	0		0	0		0		0	0	0
16K	\$ 64	\$ 35	\$ 2	8 \$	23	\$	18	\$	15	\$ 12	\$ 11
32K	96	46		6	35		21		10	6	3
64K	284	257	21	.0	206		180		152	125	113
128K	223	150	17	6	184		155		118	95	92
256K	174	272	47	6	570		564		493	481	439
512K	14	68	24	2	343		305		270	230	196
1M	0	12	4	13	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		<u> </u>	0		0	_	0	0	5
Total	\$856	\$841	\$1,22	1 \$1	L,606	\$1,	711	\$1	,713	\$1,861	\$2,144
% Change from											
Previous Year		(2%)	45	%	32%	•	7%		0%	9%	15%
Α.	ī	985	1986	1987		<u>ions</u> 988	of U	_	s 1990	1991	1992
4K		0	0		0	0		0	() 0	0
8K		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		. 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 1	21.0	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	(00	0
Total	2	36.7	244.9	271.	8 3	08.8	304	.7	288.4	283.5	290.9
% Change from											
Previous Year			3%	13	.%	14%	(19	b)	(5%)	(2%)	3%

(Continued)

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>	1989	1990	<u>1991</u>	<u>1992</u>		
4K	0	0	0	0	0	0	o	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		
M8	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

Table 5
Worldwide NMOS UV Market

	Millions of Dollars											
	1985	<u>1986</u>	<u> 1987</u>	1988	1989	<u>1990</u>	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	Q	0				
Total	\$774	\$679	\$739	\$731	\$548	\$384	\$241	\$122				
% Change from												
Previous Year		(129	s) 9%	(1%)	(25%)	(30%)	(37%)	(49%)				
			Mi		of Unit							
	<u>1985</u>	<u>1986</u>	<u>1987</u>	<u>1988</u>	<u>1989</u>	<u>1990</u>	<u>1991</u>	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%)				
				,								

Table 5 (Continued)
Worldwide NMOS UV Market

	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	\$ 2.48	\$ 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

Table 6
Worldwide CMOS UV EPROM Market

				1	Milli	ons.	of Do	1 <u>1a</u>	rs	_	
	<u> 1985</u>	<u>19</u>	<u>86</u> 1	<u>987</u>	198	8 1	<u>.989</u>	1	<u>990</u>	<u> 1991</u>	1992
4K	0		0	0	0)	0		0	0	0
8K	0		0	0	0		0		0	0	0
16K	\$10		0 \$		\$ 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			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	_	<u> </u>	_0		1	0		0	0	5
Total	\$82	\$10	62 \$	482	\$875	\$1	,163	\$1	,329	\$1,620	\$2,022
% Change from											
Previous Year		91	8% 1	98%	82%	•	33%		14%	22%	25%
											也
	_						ns of				
	19	<u>85</u>	<u>1986</u>	<u>19</u>	<u>87 1</u>	<u>988</u>	<u> 198</u>	9	<u>1990</u>	<u>1991</u>	<u>1992</u>
4K		0	0		0	0		0	(0 0	0
8K		0	0		0	0		0	1	0 0	0
16K	3	٠.	0	2	. 4	3.3	2	.7	2.		
32K		.5	2.7	3	.1	2.5		. 4	0.		
64K		.5	16.3	23		30.4			24.		
128K		.5	1.9	10		16.7			15.		
256K	3	. 2	14.1	45		65.4			79.		
512K		0	0.3		. 9	22.4			32.		
IM		0	0.1	1	.3	11.6			53.		
2M		0	0		0	. 0		.4	2.		
4M		0	0		0	0		0	0.		
8M		_0	0		<u> </u>	0		_0		<u> </u>	0
Total	15	.7	35.4	95	.0 1	.52.1	189	. 9	210.	7 234.3	265.5
% Change from											
Previous Year			125%	16	8%	60%	2	5%	11	% 11%	13%
•										(Con	tinued)

Table 6 (Continued) Worldwide CMOS UV EPROM Market

	Average Selling Price (\$)									
	<u> 1985</u>	<u>1986</u>	<u> 1987</u>	1988	1989	<u>1990</u>	<u> 1991</u>	<u>1992</u>		
4K	0	0	0	0	0	ø	: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

Table 7

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

	Millions of Dollars								
	<u> 1985</u>	<u>1986</u>	<u> 1987</u>	<u>1988</u>	1989	<u>1990</u>	<u>1991</u>	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	<u>1991</u>	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	
2М	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)

Table 7 (Continued)

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

	Average Selling Price (\$)								
	1985	<u>1986</u>	1987	<u>1988</u>	1989	1990	<u>1991</u>	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

Table 8
Worldwide NMOS OTP EPROM Market

	Millions of Dollars							
	1985	1986	<u>1987</u>	1988	1989	1990	1991	1992
4K	0	0	0	0	0	0	0	0
8K	0	0	Ŏ	0	Ö	ŏ	0	0
16K	0	0	Ö	Ö	Ö	0	Ö	Ö
32K	\$ 5	\$ 1	Ö	ŏ	Ö	Ö	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	6 7	71	55	48
512K	0	0	13	34	43	49	47	40
1M	Ö	Ö	0	0	0	0	ō	Ö
2M	Ŏ	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ
4M	_0	<u>· 0</u>	<u>°</u>	0	0	0	<u>o</u>	_ <u>0</u>
****				_	_	_ _		
Total	\$17	\$61	\$108	\$137	\$159	\$156	\$127	\$99
% Change from								
Previous Year	(19%)	266%	78%	26%	16%	(2%)	(19%)	(22%)
			M	illions	of Uni	ts		_
	<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	<u> N/A</u>	<u>. N/A</u>	<u> N/A</u>	N/A	N/A	<u>_N/A</u>	N/A	<u>N/A</u>
Total	7.3	21.4	32.8	38.0	44.8	44.5	36.1	28.4

N/A = Not Available

(Continued)

Table 8 (Continued)
Worldwide NMOS OTP EPROM Market

	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	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/Y	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

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Table 9
Worldwide CMOS OTP EPROM Market

	Millions of Dollars							
	1985	<u>1986</u>	<u> 1987</u>	1988	1989	1990	<u>1991</u>	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	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> </u>	0	0	0	0	0	0	0
Total	\$3	\$11	\$18	\$40	\$63	\$123	\$184	\$208
% Change from								
Previous Year		228%	67%	124%	58%	96%	49%	13%
			M	illions	of IIni			
	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	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>	N/A
Total	1.0	2.9	4.9	7.0	10.7	21.5	37.7	47.1

N/A = Not Available

(Continued)

Table 9 (Continued) Worldwide CMOS OTP EPROM Market

	Average Selling Price (\$)								
	1985	<u>1986</u>	<u>1987</u>	1988	<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	\$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	И/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

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.

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.

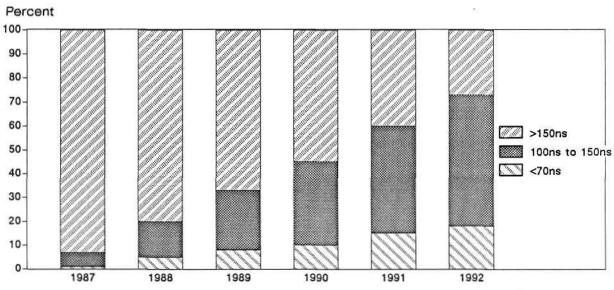
High-Speed EPROMs

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.

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.

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.

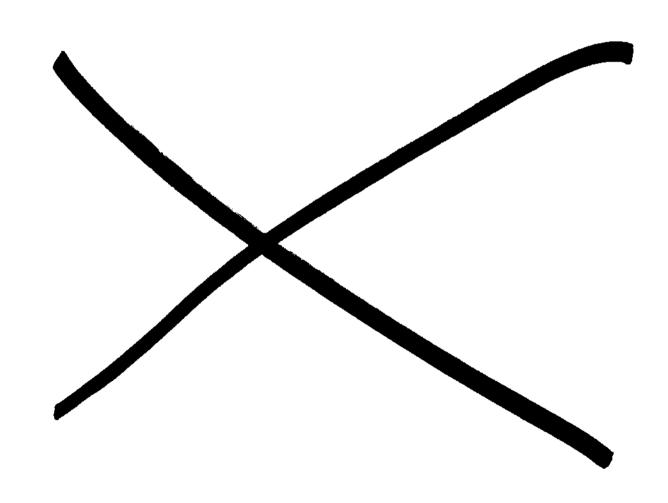
Short-Term Forecast

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.

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.



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

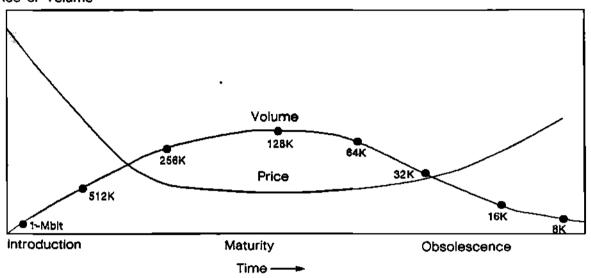
THE MOS EPROM PRODUCT LIFE CYCLES

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.

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.

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.

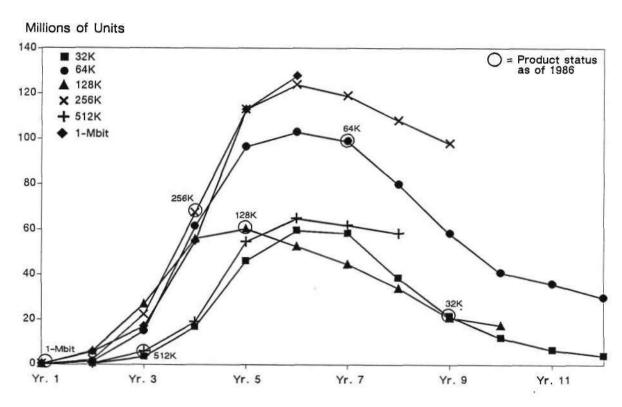
It is interesting to note that although several manufacturers began shipping new 256K and 512K densities in 1984, market growth resulted from increased unit shipments of the more mature devices—32K, 64K, and 128K devices. Tight capacity situations and a variety of technical, manufacturing, and market 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.

Figure 2

MOS EPROM PRODUCT LIFE CYCLES BY DENSITY



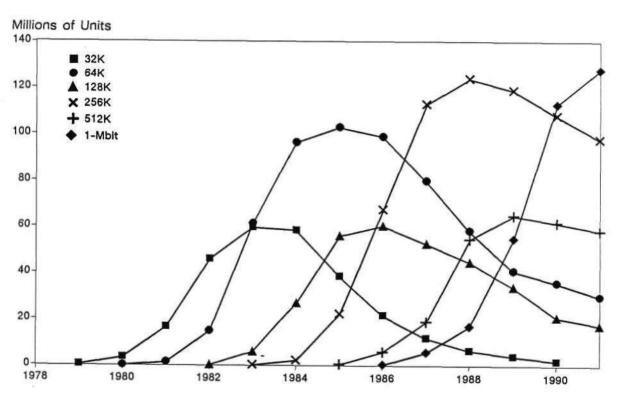
Source: Dataquest April 1987

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.

Figure 3

MOS EPROM PRODUCT LIFE CYCLES THROUGH TIME

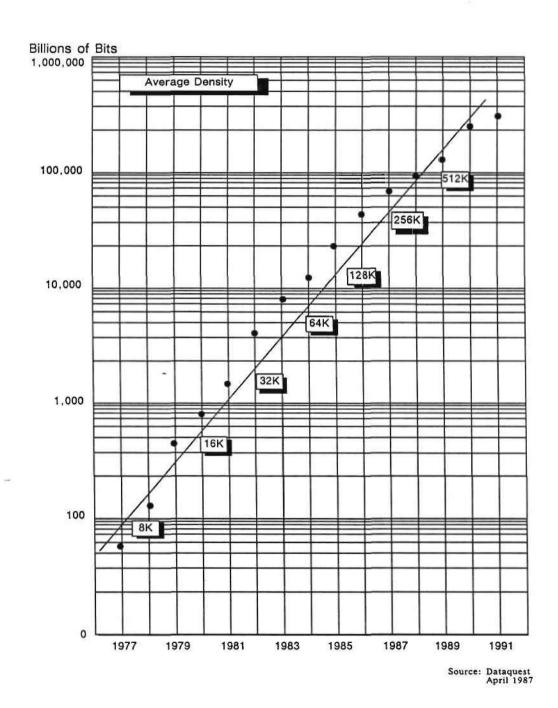


Source: Dataquest April 1987

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.

Figure 4
ESTIMATED MOS EPROM BIT GROWTH



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.

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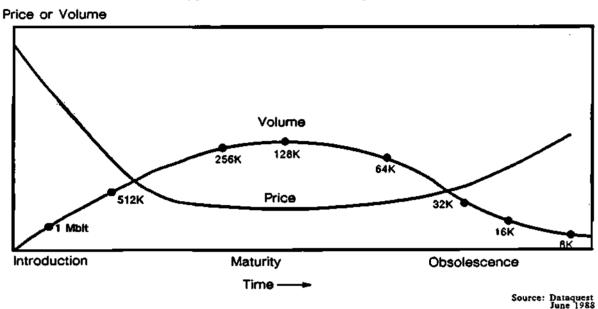
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The life cycle of a device and of the equipment into which it is being designed should always be compared. Selecting a device in its decline phase may force the equipment manufacturer to pay a premium price for an obsolete product, or to make a lifetime 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.

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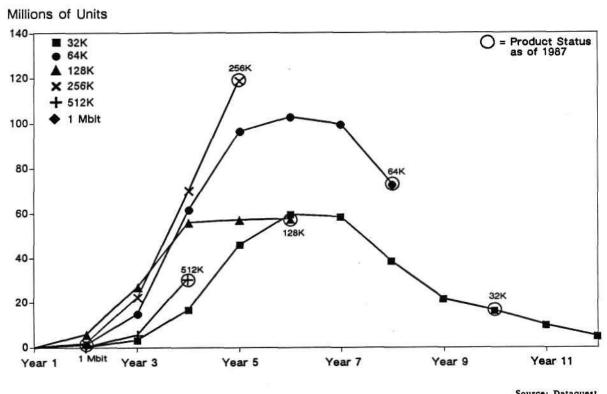
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Figure 2

MOS EPROM Product Life Cycles by Density



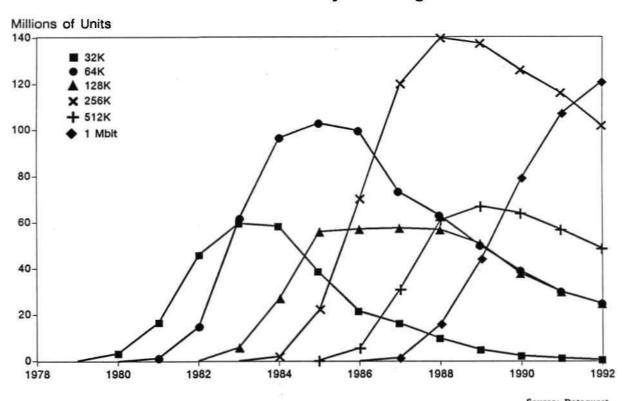
MOS EPROM---Product Life Cycles

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MOS EPROM--Product Life Cycles

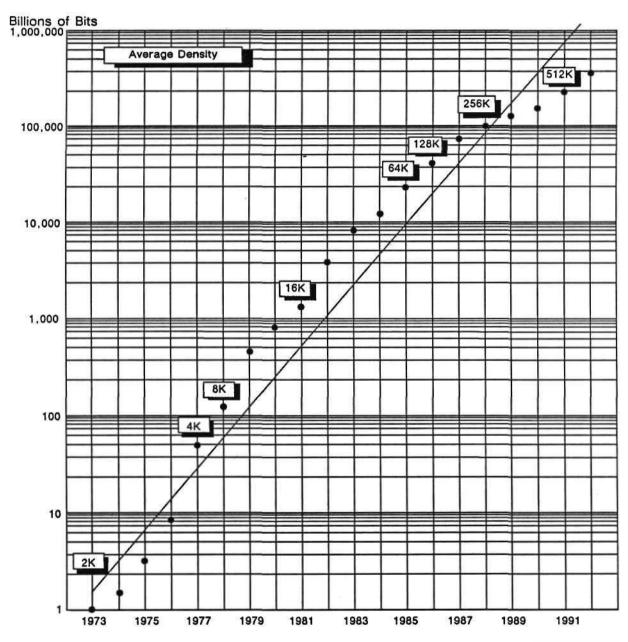
BIT-GROWTH ANALYSIS

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 our 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

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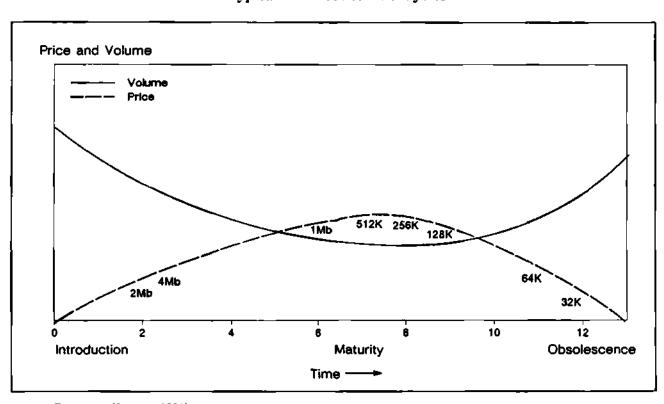


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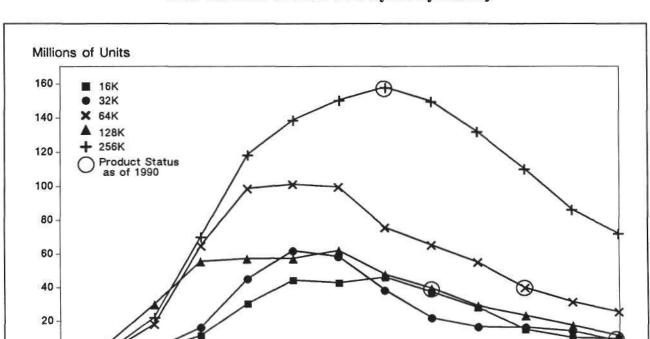
Source: Dataquest (January 1991)

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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.



7

9

11

5

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

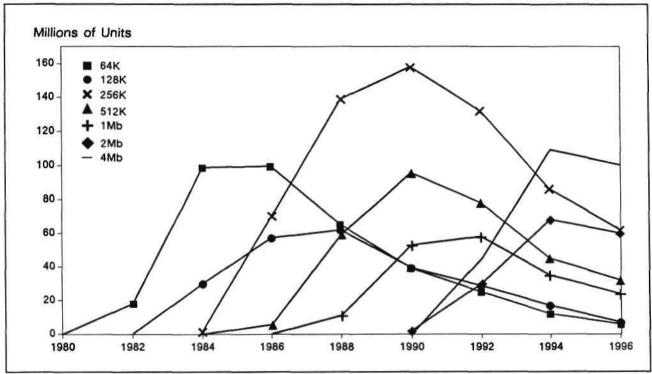
The forecast behavior of each density throughout time is illustrated in Figure 4. The historical two-year interval between density introduction changed with the 256K EPROM. The 256K was introduced in 1983, one year after the 128K and was followed by the 512K in 1984 and the 1Mb EPROM in 1985. Production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

Billions of Bits 10,000,000 Accumulated Bits Average Density 1,000,000 ■ 1Mb 2Mb 256K 128K 100,000 64K ■ 10,000 16K 1,000 100 2K 10

1981

1985

1989

1993

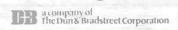
Figure 5
Estimated MOS EPROM Bit Growth

Source: Dataquest (January 1991)

1973

1977

Dataquest



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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.

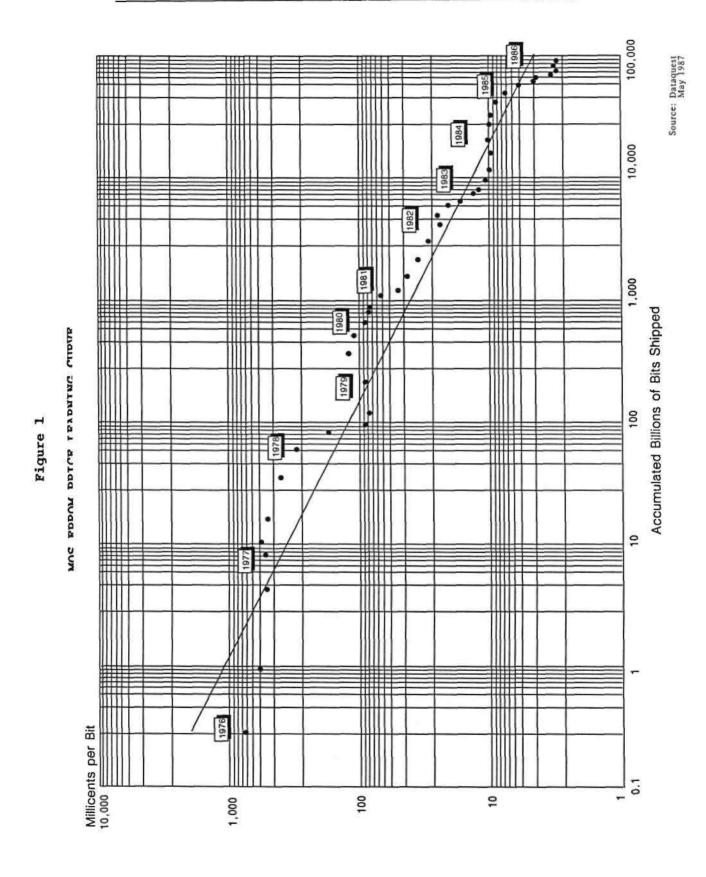
The objective of this section is to illustrate the application of learning curves to overall MOS EPROM and specific MOS EPROM device density prices. The curves are plotted on a logarithmic scale in order to show the relationship of the percent change in price relative to the percent change in cumulative 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.



16K MOS EPROM PRICE LEARNING CURVE Figure 2

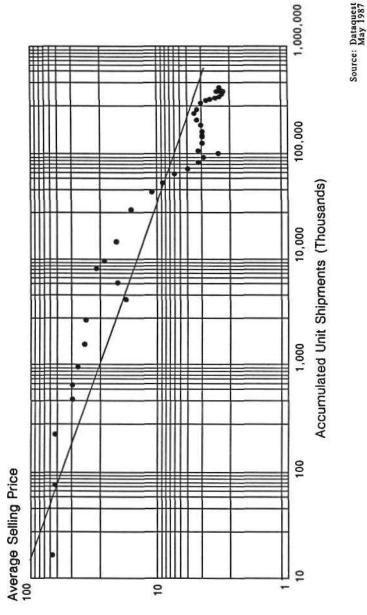
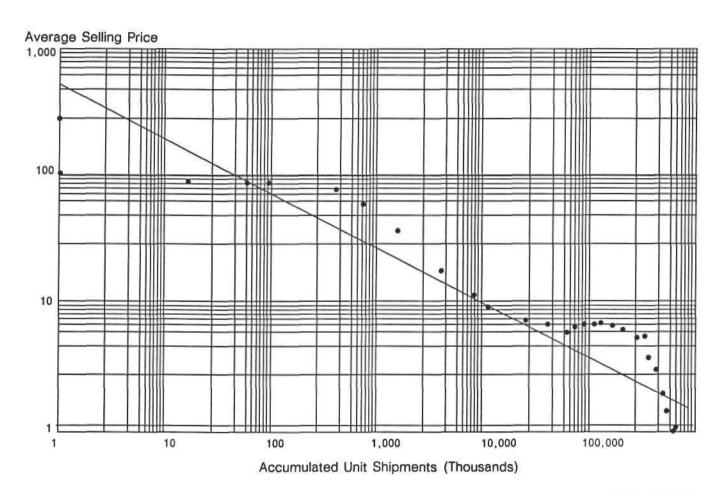


Figure 3
64K MOS EPROM PRICE LEARNING CURVE

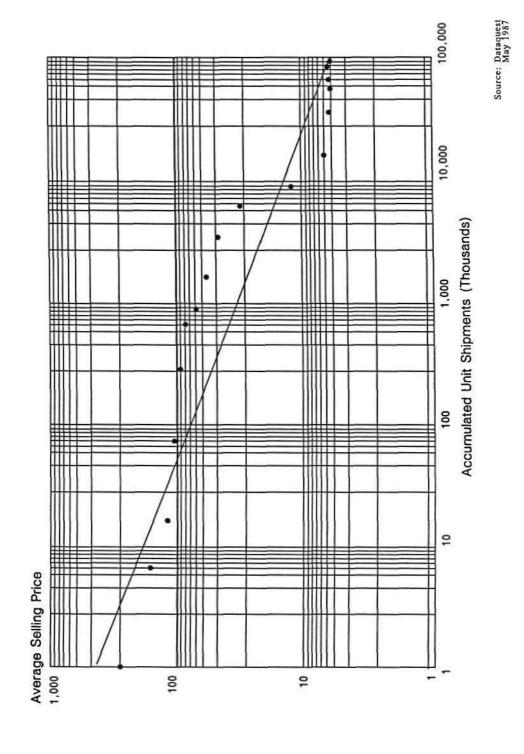


Source: Dataquest May 1987 MOS EPROM--Price

Learning

Curves

Figure 4
256K MOS EPROM PRICE LEARNING CURVE



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OVERVIEW OF PRICE LEARNING CURVES

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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.

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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.

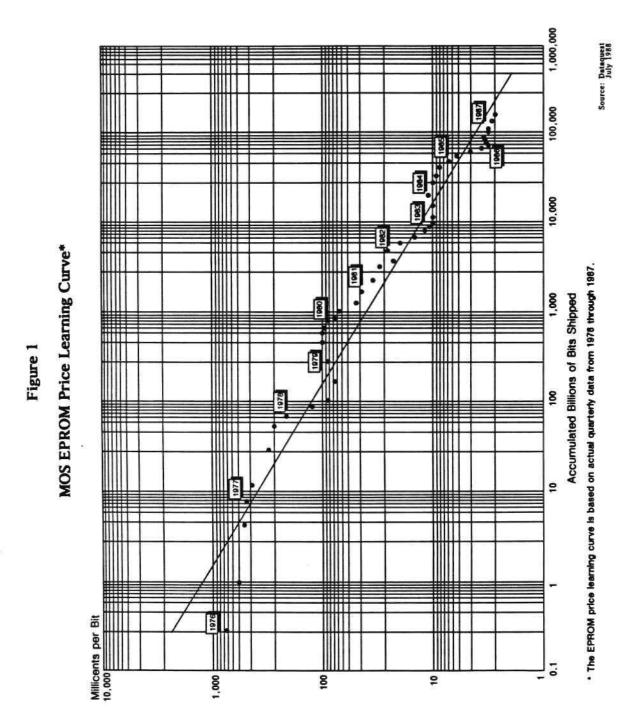
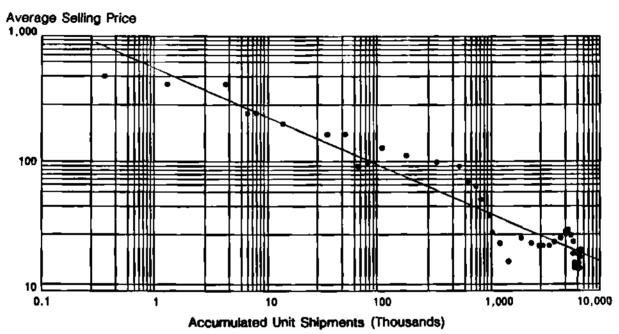


Figure 2

16K MOS EPROM Price Learning Curve*

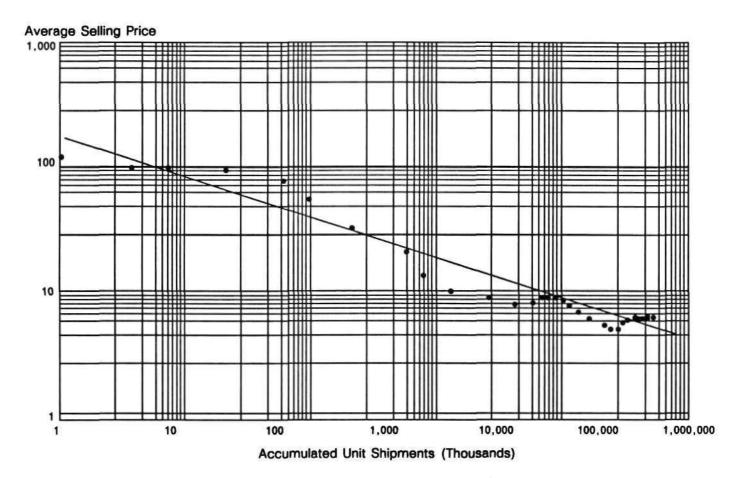


* The 16K EPROM price learning curve is based on actual quarterly data from 1976 through 1967

Source: Dataquest July 1988 0

1988 Dataquest Incorporated July

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

Figure 4
256K MOS EPROM Price Learning Curve*

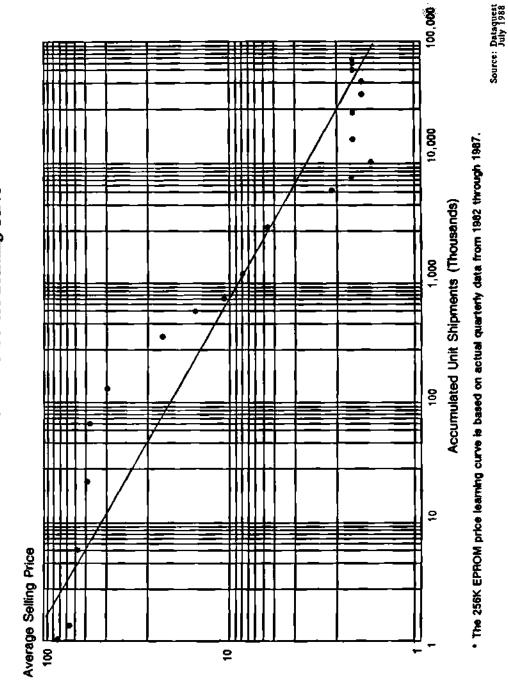
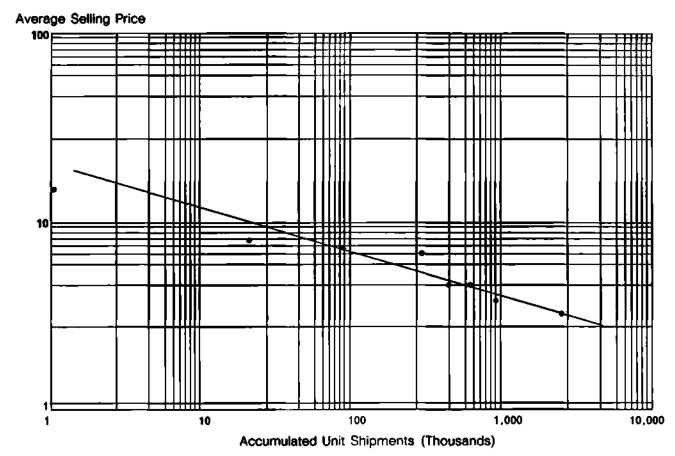


Figure 5

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 ŧ?

EPROM-

-Price

Learning

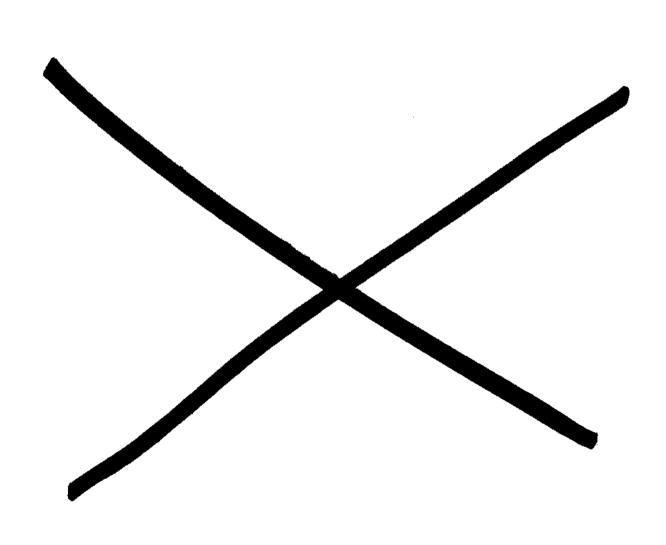
Curves

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.

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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

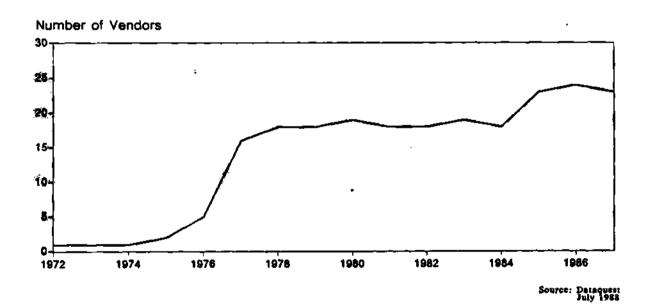
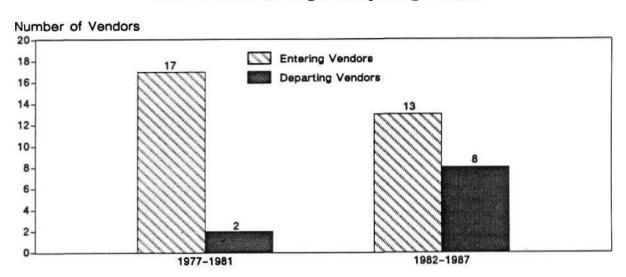


Figure 2

MOS EPROM Entering and Departing Vendors



Source: Dataquest

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.

Table 1

MOS EPROM Top 5/10 Vendor Concentration

Top 5/10 Concentration	1978	1979	1980	1981	1982
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
Top 5/10 Concentration	1983	1984	1985	1986	1987
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

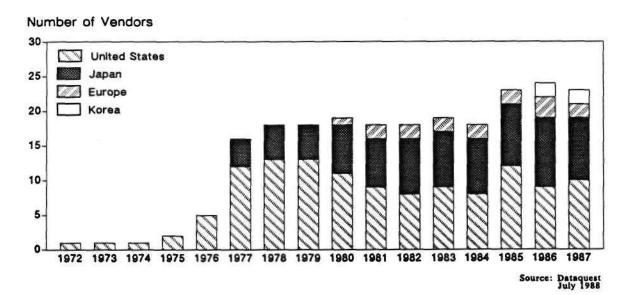


Figure 4

16K MOS EPROM Vendor Base by Region

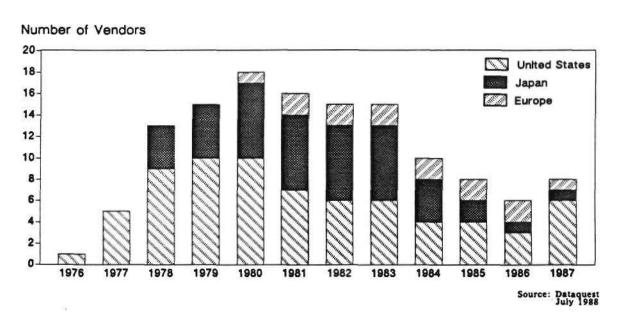


Figure 5
32K MOS EPROM Vendor Base by Region

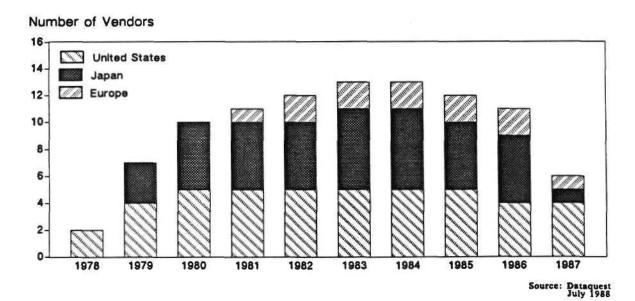


Figure 6
64K MOS EPROM Vendor Base by Region

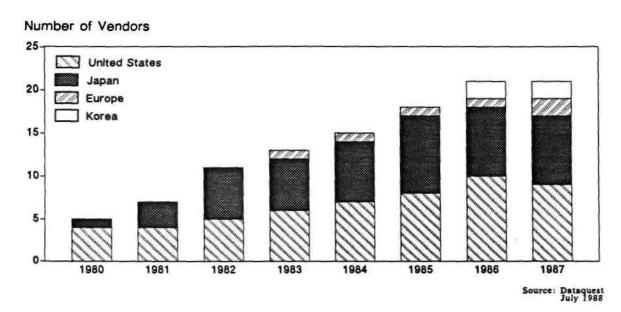


Figure 7

128K MOS EPROM Vendor Base by Region

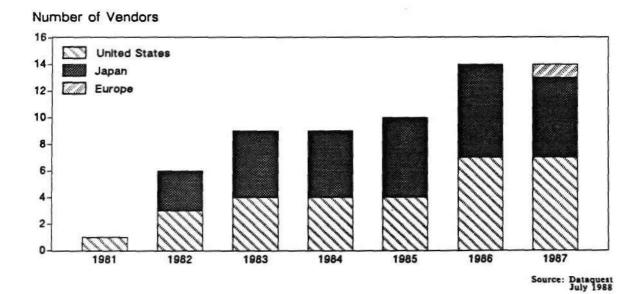


Figure 8
256K MOS EPROM Vendor Base by Region

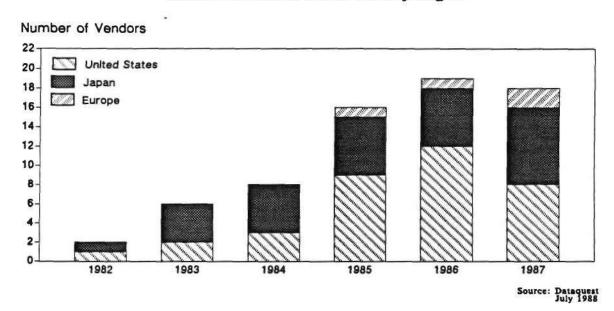


Figure 9
512K MOS EPROM Vendor Base by Region

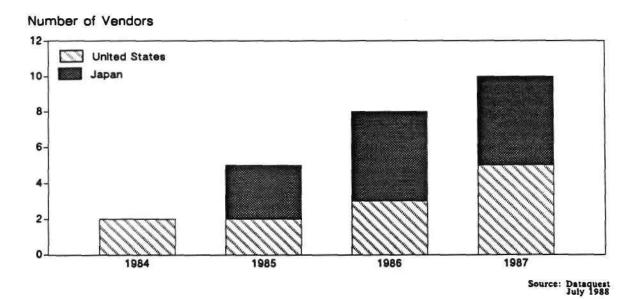
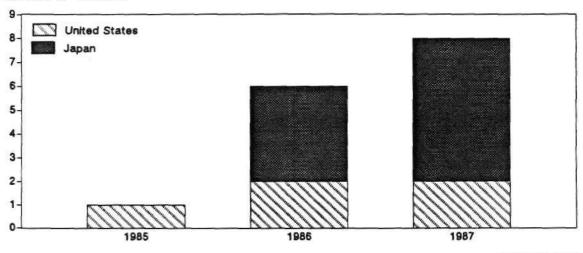


Figure 10
1-Mbit MOS EPROM Vendor Base by Region

Number of Vendors



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.

Table 2 **EPROM Regional Vendor Concentration**

Regional Concentration	1978	<u> 1979</u>	1980	1981	<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 (\$	BM) 0	0	0	0	0
Regional Concentration	1983	1984	1985	1986	1987
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%	45	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

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.

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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:

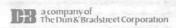
- Table 1--EPROM Market Shares (Percentages)
- Table 2--EPROM Market Shares (Dollarized Unit Shares in Thousands)
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- ◆ Table 7--16K EPROM Market Shares (Percentages)

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- 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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OVERVIEW OF MOS EPROM MARKET SHARES

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- 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.

Table 1

MOS EPROM Market Shares
(Percentages)

Company	<u> 1976</u>	<u> 1977</u>	<u> 1978</u>	<u> 1979</u>	1980	<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	б	5
National	0	4	8	7	5	4
NEC	0	0	0	0	2	4
Oki	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	G	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)

Table 1 (Continued)

MOS EPROM Market Shares (Percentages)

<u>Company</u>	1982	<u>1983</u>	1984	<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	O	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	0	0	0	0	<u> 0</u>	0
Total	100%	100%	100%	100%	100%	100%

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

Source: Dataquest

Table 2

MOS EPROM Market Shares
(Dollarized Unit Shares in Thousands)

Company	1976	<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)

Table 2 (Continued)

MOS EPROM Market Shares (Dollarized Unit Shares in Thousands)

Company	1982	<u>1983</u>	1984	<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	Ď	Ō	Ď	ō	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.	O	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
0ki	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
Seeq	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

Table 3

MOS EPROM Regional Shares
(Percentages)

Regional Shares	<u>1976</u>	<u> 1977</u>	<u>1978</u>	<u>1979</u>	<u>1980</u>	<u>1981</u>
United States Japan Europe Korea	77.8% 22.2 0 0	76.7% 23.3 0 0	92.0% 8.0 0 0	87.5% 12.5 0 0	71.5% 25.5 2.9 0	66.3% 33.4 0.3
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Regional Shares	1982	<u>1983</u>	<u>1984</u>	<u>1985</u>	<u>1986</u>	<u> 1987</u>
United States Japan Europe Korea	51.9% 45.1 3.1	48.5% 48.5 3.0	46.4% 50.0 3.6	39.9% 54.2 5.9	39.9% 55.5 4.6	44.5% 47.4 8.0
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

Table 4

MOS EPROM Regional Shares
(Dollarized Unit Shares in Thousands)

Regional Shares	<u> 1976</u>	1977	<u>1978</u>	<u>1979</u>	<u>1980</u>	<u>1981</u>
United States	8,397	62,189	115,743	321,759		
Japan	2,328	16,985	7,827	57,841		
Europe	0	0	0	0	17,617	636
Korea	0	0	0	0		0
Total	10,725	79,174	123,570	379,600	514,210	326,316
Regional Shares	1982	1983	<u>1984</u>	<u>1985</u>	1986	1987
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

Table 5

MOS EPROM Top 10 Shares (Percentages)

Top 5 and					
10 Shares	<u>1978</u>	<u> 1979</u>	<u>1980</u>	<u>198</u> 1	1982
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
Top 5 and					
10 Shares	<u> 1983</u>	1984	<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

Table 6

8K EPROM Market Shares
(Percentages)

Company	<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	23.0	<u>24.0</u>	0.4	<u> </u>	0.2
Total	100.0%	100.0%	100.0%	100.0%	100.0%

Company	1981	1982	<u>1983</u>	1984	<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	0	0	0	0	0	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

Table 7

16K EPROM Market Shares
(Percentages)

Company	1976	1977	<u>1978</u>	1979	1980	1981
AMD	0	0	0	0.1%	1.15	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
Pujitsu	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	Ó	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
Symertek	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
ÄÄD	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	Ō	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
		0 1.1	2.6 0	6.2 0	0 0	0
Thomson	0	•			_	-

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

Source: Dataquest

Table 8

32K EPROM Market Shares
(Percentages)

Company	<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	0	0	0	0	0
Total	100.0%	100.0%	100.0%	100.0%	100.0%
Сомрану	<u>1983</u>	1984	<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	0	<u>0,1</u>	<u>0.3</u>	0	Q
Total	100.0%	100.0%	100.0%	100.0%	100.0%

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

Source: Dataquest

Table 9

64K EPROM Market Shares
(Percentages)

Company	<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
Oki	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

Table 10
128K EPROM Market Shares
(Percentages)

<u>Company</u>	<u>1982</u>	1983	<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
Oki	0	0	0	0	0	4.0
SGS-Thomson	Ō	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	0	0	0	0	0	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

Table 11
256K EPROM Market Shares
(Percentages)

Company	<u>1983</u>	<u>1984</u>	<u> 1985</u>	1986	<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	C	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	0	0	0	0	0
Total	100.0%	100.0%	100.0%	100.0%	100.0%

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

Source: Dataquest

Table 12
512K EPROM Market Shares
(Percentages)

Company	<u>1984</u>	<u>1985</u>	<u> 1986</u>	1987
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	Q	0	_0.3	0
Total	100.0%	100.0%	100.0%	100.0%

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

Source: Dataquest

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>	9.0
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.

- 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:

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Slow response to consumer demand for new products

Rising labor costs and poor wire bonding

Low yields

<u>Action</u>

Imported CAD equipment to speed up design process

Automated equipment

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

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.

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)

- 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.

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

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 the following 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

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.

control

In July 1975, Nippon Telegraph and Telephone (NTT) and Ministry of International Trade and Industry (MITI) 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 (approximately \$300 million) and consisted of the two government 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 these 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 was 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 that included Matsushita, Seiko-Epson, 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 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.

Table 1

MOS EPROM Market Shares
(Percentages)

Total	Others	WaferScale	VLSI Technology	Toshiba	Thomson	Texas Instruments	Synertek	Signetics	Sharp	SGS	Seiko-Epson	SEEQ	Rockwell .	Ricoh	Oki	NEC	National	Motorola	Mostek	Mitsubishi	Microchip Tech., Inc.	Matsushita	Intel	Hyundai	Hitachi	GoldStar	General Instrument	Fujitsu	Fairchild	Eurotechnique	Electronic Array	Cypress	Catalyst	Atmel	AMD	Company
100%	6	0	0	22	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	74%	0	o	0	0	0	0	0	0	•	0	0	0	1976
100%	b	0	0	19	0	10	0	0	0	•	0	0	٥	0	0	0	. 4	2	0	o	0	٥	59	0	0	0	o	2	0	0	4.8	0	0	o	0	1977
100%	6	o	0	0	0	28	0	0	0	0	0	0	0	0	0	o	œ	8	0	4	0	0	44	0	۳	•	0	N	2	0	۲	o	0	0	ω ø	1978
100%	<u> </u>	o	0	Ŋ	0	30	0	0	0	0	0	0	0	0	٥	0	7	9	4	2	0	0	27	0	Ō	•	0	υ	2	0	_	0	0	0	4	1979
100%	6	0	0	ω	0	24	0	0	0	ω	0	o	0	Φ	0	N	υī	6	ω	4	0	٥	23	0	9	0	0	9	4	0	0	0	0	0	w P	1980
100%	6	0	0	H	0	20	0	0	0	0	0	0	0	0	o	4	41	σı	ω	o,	0	μ	29	0	12	0	0	œ	_	0	0	٥	0	0	4.9	1981

(Continued)

Table 1 (Continued)

MOS EPROM Market Shares
(Percentages)

Total	Others	WaferScale	VLSI Technology	Toshiba	Thomson	Texas Instruments	Synertek	Signetics	Sharp	SGS	Seiko-Epson	SEEQ	Rockwell	Ricoh	Oki	NEC	National	Motorola	Mostek		Microchip Tech., Inc.	Matsushita	Intel	Hyundai	Hitachi	GoldStar	General Instrument	Fujitsu	Fairchild	Eurotechnique	Electronic Array	Cypress	Catalyst	Atme1	AMD	Company
100%	0	0	0	ω	•	6 0	0	0	0	ш	0	0	0	0	ם	10	4	N	۲	10	0	0	28	0	12	0	0	12	0	,	0	0	0	0	7%	1982
100%	0	•	0	N	Φ	11	0	0	•	μ	0	–	0	0	<u>,,</u>	œ	(J)	_	0	9	0	0	24	0	15	0	o	Ħ	0	μ	0	0	0	0	98	1983
100%	0	0	0	4.	۲	11	0	0	0	2	0	ω	0	0	1	o	4	۲	0	13	0	0	16	0	17	0	0	11	0	0	0	Φ	0	0	10%	1984
100%	b	0	0	0	1	O	0	0	0	ω	0	N	0	0	0	9	ω	0	0	11	0	0	18	0	16	0	0	12	0	0	0	0	0	0	11%	1985
100%	0	0	0	. 7	0	4	0	0	0	ω	0	_	0	0	0	9	N	0	0	14	0	0	23	0	16	0	N	9	0	0	0	0	0	0	8	1986
100%	6	0	0	10	0	7	0	_	0	7	0	_	0	0	2	44	σ'n	0	0	9	ω	0	18	0	10	0	0	Ħ	0	0	0	0	0	0	8.8	1987

(Continued)

Table 1 (Continued)

MOS EPROM Market Shares (Percentages)

Сопрапу	<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	1
Total	100%

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

Source: Dataquest

MOS EPROM Market Shares
(Dollarized Unit Shares in Thousands)

Table 2

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

(Continued)

Table 2 (Continued)

MOS EPROM Market Shares (Dollarized Unit Shares in Thousands)

Company	<u>1982</u>	1983	1984	<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	<u>264</u>	340	0
Total	542,947	879,305	1,319,619	866,333	910,367	1,349,822

(Continued)

Table 2 (Continued)

MOS EPROM Market Shares (Dollarized Unit Shares in Thousands)

Company		1988
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		9,271
Total	\$1	.868.444

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

Source: Dataquest

Table 3

MOS EPROM Regional Shares
(Percentages)

Regional Shares	<u>1976</u>	<u> 1977</u>	<u>1978</u>	<u>1979</u>	<u>1980</u>	<u>1981</u>
United States Japan Western Europe South Korea	77.8% 22.2 0 0	76.7% 23.3 0 0	92.0% 8.0 0 0	87.5% 12.5 0 0	71.5% 25.5 2.9	66.3% 33.4 0.3
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Regional Shares	<u>1982</u>	<u>1983</u>	<u>1984</u>	<u>1985</u>	<u>1986</u>	<u>1987</u>
United States Japan Western Europe South Korea	51.9% 45.1 3.1 0	48.5% 48.5 3.0	46.4% 50.0 3.6	39.9% 54.2 5.9	39.9% 55.5 4.6	43.9% 47.4 8.7 0.1
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

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

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

Source: Dataquest

Table 4

MOS EPROM Regional Shares
(Dollarized Unit Shares in Thousands)

Regional Shares	<u>1976</u>	<u> 1977</u>	<u>1978</u>	<u>1979</u>	1980	<u> 1981</u>
United States	8,397		•			
Japan	2,328		7,827	57,841		•
Western Europe	0	0	0	0	17,617	636
South Korea	0	0	0	0		0
Total	10,725	79,174	123,569	379,600	514,208	326,317
Regional Shares	1982	1983	<u>1984</u>	1985	<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	<u>630</u>
Total	542,947	879,305	1,319,619	866,333	910,367	1,349,822
Regional Shares	<u>1988</u>					
United States	879,3	14		-		
Japan	740,0	41				
Western Europe	246,327					
South Korea	2,762					
Total	1,868,4	44				

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

Source: Dataquest

Table 5

MOS EPROM Top 10 Shares
(Percentages)

Top 5 and	•					
10 Shares		<u>1978</u>	<u>1979</u>	<u>1980</u>	1981	<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
Top 5 and						
10 Shares	<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%	D
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

 Table 6
 8K EPROM Market Shares (Percentages)

Company	<u>1976</u>	<u> 1977</u>	<u>1978</u>	1979	<u>1980</u>
AMD	o	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	23.0	24.0	0.4	<u> 1.5</u>	0.2
Total	100.0%	100.0%	100.0%	100.0%	100.0%

Company	<u>1981</u>	<u>1982</u>	1983	<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	O	0	0
Texas Instruments	24.0	12.4	50.0	0	0	0
Toshiba	0	0	0	0	0	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

Table 7

16K EPROM Market Shares
(Percentages)

Company	<u>1976</u>	1977 0	1978 0	1979 0.1%	1980 1.1%	1981 4.18
AMD	G O	0	0	0.14	0	4.12
Cypress	0	0	0	0	Ö	ŏ
Eurotechnique	•	0	0	0	2.9	0.3
Fairchild	0	0	0.2%	7.5	9.6	6.6
Fujitsu	0	0	1.5	10.2	12.7	11.9
Hitachi	66.7%	72.3%	57.0	25.9	17.9	26.0
Intel		12.34	37.0	0	0.6	1.6
Matsushita	0	Ö	Ö	1.5	3.7	5.6
Mitsubishi	-	0	1.1	7.3	4.3	6.3
Mostek	0	0	4.2	5.8	5.2	3.9
Motorola	0	-			4.0	6.4
National	0	0	0	2.2	0.7	4.3
NEC	0	0	0	0.0	0.7	0.5
Ok1	0	0	0	0	-	0.4
SGS	0	0	0	C C	5.9	0.4
Synertek	0	0	0	•	0.8	-
Texas Instruments	33.3	27.7	35.9	36.3	26.3	20.4
Thomson	0	0	0	0	0	. 0
Toshiba	Q	0	0.2	3.2	4.5	1.7
WaferScale	0	0	0	0	0	<u> </u>
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Company	1982	<u>1983</u>	<u>1984</u>	<u>1985</u>	<u>1986</u>	<u>1987</u>
<u>Company</u> AMD	1982 9.8%	1983 7.8%	1984 12.48	21.0%	20.0%	14.3%
				21.0%		
AMD	9.8%	7.8%	12.48	21.0%	20.0%	14.3%
AMD Cypress	9.8%	7.8%	12.48	21.0%	20.0%	14.38
AMD Cypress Eurotechnique	9.8% 0 3.7	7.8% 0 1.7	12.48	21.0%	20.0%	14.3% 9.3 0
AMD Cypress Eurotechnique Fairchild	9.8% 0 3.7	7.8% 0 1.7	12.48 0 0	21.0% 0 0	20.0% 0 0	14.3% 9.3 0
AMD Cypress Eurotechnique Fairchild Fujitsu	9.8% 0 3.7 0 2.6	7.8% 0 1.7 0	12.48 0 0 0	21.0% 0 0 0 0	20.0% 0 0 0 0	14.3% 9.3 0 0
AMD Cypress Eurotechnique Fairchild Fujitsu Hitachi	9.8% 0 3.7 0 2.6 2.6	7.8% 0 1.7 0 0.2	12.48 0 0 0 0	21.0% 0 0 0 0	20.0% 0 0 0 0	14.3% 9.3 0 0
AMD Cypress Eurotechnique Fairchild Fujitsu Hitachi Intel	9.8% 0 3.7 0 2.6 2.6	7.8% 0 1.7 0 0.2 0.5 7.6	12.48 0 0 0 0 0	21.0% 0 0 0 0 0	20.0% 0 0 0 0 0	14.3% 9.3 0 0 0
AMD Cypress Eurotechnique Fairchild Fujitsu Hitachi Intel Matsushita	9.8% 0 3.7 0 2.6 2.6 19.8	7.8% 0 1.7 0 0.2 0.5 7.6 0.9	12.48 0 0 0 0 0 0	21.0% 0 0 0 0 0	20.0% 0 0 0 0 0 0 0	14.38 9.3 0 0 0 8.2
AMD Cypress Eurotechnique Fairchild Pujitsu Hitachi Intel Matsushita Mitsubishi	9.8% 0 3.7 0 2.6 2.6 19.8 1.8 2.9	7.8% 0 1.7 0 0.2 0.5 7.6 0.9	12.48 0 0 0 0 0 0 1.6 0.3 1.3	21.0% 0 0 0 0 0 0	20.0% 0 0 0 0 0 0 0 8.2	14.38 9.3 0 0 0 8.2
AMD Cypress Eurotechnique Fairchild Fujitsu Hitachi Intel Matsushita Mitsubishi Mostek	9.8% 0 3.7 0 2.6 2.6 19.8 1.8 2.9 2.8	7.8% 0 1.7 0 0.2 0.5 7.6 0.9 1.3	12.48 0 0 0 0 0 1.6 0.3 1.3	21.0% 0 0 0 0 0 0 0	20.0% 0 0 0 0 0 0 8.2 0	14.38 9.3 0 0 0 8.2 0
AMD Cypress Eurotechnique Fairchild Fujitsu Hitachi Intel Matsushita Mitsubishi Mostek Motorola	9.8% 0 3.7 0 2.6 2.6 19.8 1.8 2.9 2.8	7.8% 0 1.7 0 0.2 0.5 7.6 0.9 1.3 1.2	12.48 0 0 0 0 0 1.6 0.3 1.3	21.0% 0 0 0 0 0 0 0 0	20.0% 0 0 0 0 0 0 8.2 0 0	14.38 9.3 0 0 0 8.2 0
AMD Cypress Eurotechnique Fairchild Fujitsu Hitachi Intel Matsushita Mitsubishi Mostek Motorola National	9.8% 0 3.7 0 2.6 2.6 19.8 1.8 2.9 2.8 1.3	7.8% 0 1.7 0 0.2 0.5 7.6 0.9 1.3 1.2 0.3 26.0	12.48 0 0 0 0 0 1.6 0.3 1.3 0	21.0% 0 0 0 0 0 0 0 0 0 0.4 0	20.0% 0 0 0 0 0 0 8.2 0 0 0	14.38 9.3 0 0 0 8.2 0 0
AMD Cypress Eurotechnique Fairchild Fujitsu Hitachi Intel Matsushita Mitsubishi Mostek Motorola National NEC	9.8% 0 3.7 0 2.6 2.6 19.8 1.8 2.9 2.8 1.3 15.3	7.8% 0 1.7 0 0.2 0.5 7.6 0.9 1.3 1.2 0.3 26.0 18.9	12.48 0 0 0 0 1.6 0.3 1.3 0 0 33.0 11.3	21.0% 0 0 0 0 0 0 0 0 0.4 0 0 28.1 6.2	20.0% 0 0 0 0 0 0 8.2 0 0 0 0	14.38 9.3 0 0 0 8.2 0 0 0 8.1 1.6
AMD Cypress Eurotechnique Fairchild Fujitsu Hitachi Intel Matsushita Mitsubishi Mostek Motorola National NEC	9.8% 0 3.7 0 2.6 2.6 19.8 1.8 2.9 2.8 1.3 15.3 10.0 3.4	7.8% 0 1.7 0 0.2 0.5 7.6 0.9 1.3 1.2 0.3 26.0 18.9 3.3 6.5	12.4% 0 0 0 0 1.6 0.3 1.3 0 0 33.0 11.3 2.4 7.4	21.0% 0 0 0 0 0 0 0 0 28.1 6.2 1.8 13.9	20.0% 0 0 0 0 0 0 8.2 0 0 0 0 36.4 3.9 0	14.3% 9.3 0 0 0 8.2 0 0 0 8.1 1.6 0 45.9
AMD Cypress Eurotechnique Fairchild Fujitsu Hitachi Intel Matsushita Mitsubishi Mostek Motorola National NBC Oki SGS	9.8% 0 3.7 0 2.6 2.6 19.8 1.8 2.9 2.8 1.3 15.3 10.0 3.4 2.7	7.8% 0 1.7 0 0.2 0.5 7.6 0.9 1.3 1.2 0.3 26.0 18.9 3.3 6.5	12.4% 0 0 0 0 1.6 0.3 1.3 0 0 33.0 11.3 2.4 7.4 0 27.7	21.0% 0 0 0 0 0 0 0 0 28.1 6.2 1.8 13.9 0 22.4	20.0% 0 0 0 0 0 8.2 0 0 0 36.4 3.9 0 12.6	14.3% 9.3 0 0 0 8.2 0 0 0 6.1 1.6 0 45.9 0
AMD Cypress Eurotechnique Fairchild Fujitsu Hitachi Intel Matsushita Mitsubishi Mostek Motorola National NEC Oki SGS Synertek	9.8% 0 3.7 0 2.6 2.6 19.8 1.8 2.9 2.8 1.3 15.3 10.0 3.4 2.7	7.8% 0 1.7 0 0.2 0.5 7.6 0.9 1.3 1.2 0.3 26.0 18.9 3.3 6.5	12.4% 0 0 0 0 1.6 0.3 1.3 0 0 33.0 11.3 2.4 7.4	21.0% 0 0 0 0 0 0 0 0 28.1 6.2 1.8 13.9	20.0% 0 0 0 0 0 8.2 0 0 0 36.4 3.9 0 12.6 18.8	14.3% 9.3 0 0 0 8.2 0 0 0 8.1 1.6 0 45.9
AMD Cypress Eurotechnique Fairchild Fujitsu Hitachi Intel Matsushita Mitsubishi Mostek Motorola National NEC Oki SGS Synertek Texas Instruments	9.8% 0 3.7 0 2.6 2.6 19.8 1.8 2.9 2.8 1.3 15.3 10.0 3.4 2.7 0 17.7	7.8% 0 1.7 0 0.2 0.5 7.6 0.9 1.3 1.2 0.3 26.0 18.9 3.3 6.5 0	12.4% 0 0 0 0 1.6 0.3 1.3 0 33.0 11.3 2.4 7.4 0 27.7 2.6	21.0% 0 0 0 0 0 0 0 0 0 0 28.1 6.2 1.8 13.9 0 22.4 6.2	20.0% 0 0 0 0 0 0 8.2 0 0 0 36.4 3.9 0 12.6 0 18.8	14.3% 9.3 0 0 0 8.2 0 0 0 8.1 1.6 0 45.9 0 10.7
AMD Cypress Eurotechnique Fairchild Fujitsu Hitachi Intel Matsushita Mitsubishi Mostek Motorola National NEC Oki SGS Synertek Texas Instruments Thomson	9.8% 0 3.7 0 2.6 2.6 19.8 1.8 2.9 2.8 1.3 15.3 10.0 3.4 2.7 0 17.7	7.8% 0 1.7 0 0.2 0.5 7.6 0.9 1.3 1.2 0.3 26.0 18.9 3.3 6.5 0 22.8	12.4% 0 0 0 0 1.6 0.3 1.3 0 0 33.0 11.3 2.4 7.4 0 27.7 2.6	21.0% 0 0 0 0 0 0 0 0 0 28.1 6.2 1.8 13.9 0 22.4 6.2	20.0% 0 0 0 0 0 8.2 0 0 0 36.4 3.9 0 12.6 18.8	14.38 9.3 0 0 0 8.2 0 0 0 8.1 1.6 0 45.9 0 10.7

Table 7 (Continued)

16K EPROM Market Shares (Percentages)

Company	<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	9.7
Total	100.0%

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

Source: Dataquest

Table 8

32K EPROM Market Shares
(Percentages)

Company	1978	<u>1979</u>	<u>1980</u>	<u>1981</u>	1982
AMD	0	3.3%	7.0%	3.3%	7.0%
Eurotechnique	Ō,	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%
Company	<u>1983</u>	1984	<u>1985</u>	1986	<u> 1987</u>
AMD	7.2%	13.3%	20.0%	13.3%	11.3%
Eurotechnique	2.1	0	0	0	0
Fuj itsu	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	<u> </u>	0.3	0	0
Total	. 100.0%	100.0%	100.0%	100.0%	100.0%

Table 8 (Continued)

32K EPROM Market Shares (Percentages)

Company	1988
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	0
Total	100.0%

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

Source: Dataquest September 1989

Table 9

64K EPROM Market Shares
(Percentages)

Company	<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	G	1.5	3.0	4.4	7.0	6.5	3.3
Ok i	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	Đ	0	0.1	0.2	0.5
WaferScale	Q	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%

Table 9 (Continued)

64K EPROM Market Shares (Percentages)

Company	<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	0.6
Total	100.0%

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

Source: Dataquest

Table 10
128K EPROM Market Shares
(Percentages)

Company	1982	<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	Ō	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	Ō	2.0	6.0	15.1	14.3	4.0
Oki	0	0	0	O	0	1.0
SEEQ	0	2.3	5.5	2.1	1.9	1.0
Seiko-Epson	Ō	0	0	0	1.0	0
SGS-Thomson	0	Ō	Ō	0	0	6.0
Texas Instruments	4.4	Ö	0.3	0.2	1.2	7.0
Toshiba	0	1.2	6.0	9.3	8.9	12.0
VLSI Technology	Ō	0	0	0	0.1	0
WaferScale	0		0	0	0	Q
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Table 10 (Continued)

128K EPROM Market Shares (Percentages)

Company	<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	0
Total	100.0%

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

Source: Dataquest

Table 11
256K EPROM Market Shares
(Percentages)

Company	1983	<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	O	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	0	0	0	0	0.1
Total	100.0%	100.0%	100.0%	100.0%	100.0%

Table 11 (Continued)

256K EPROM Market Shares (Percentages)

Company	<u>1988</u>
AMD	6.09
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	0.5
Total	100.09

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

Source: Dataquest September 1989

Table 12
512K EPROM Market Shares
(Percentages)

Company	<u>1984</u>	1985	1986	<u>1987</u>	1988
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	0	0	0	0	0.3
Total	100.0%	100.0%	100.0%	100.0%	100.0%

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

Source: Dataquest

Table 13

1Mb EPROM Market Shares
(Percentages)

Company	<u>1986</u>	1987	<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>	9.0	12.0
Total	100.0%	100.0%	100.0%

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

Source: Dataquest

Table 14

The FPROM Market Sha

2Mb EPROM Market Shares (Percentages)

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

S = Sampling

Source: Dataquest

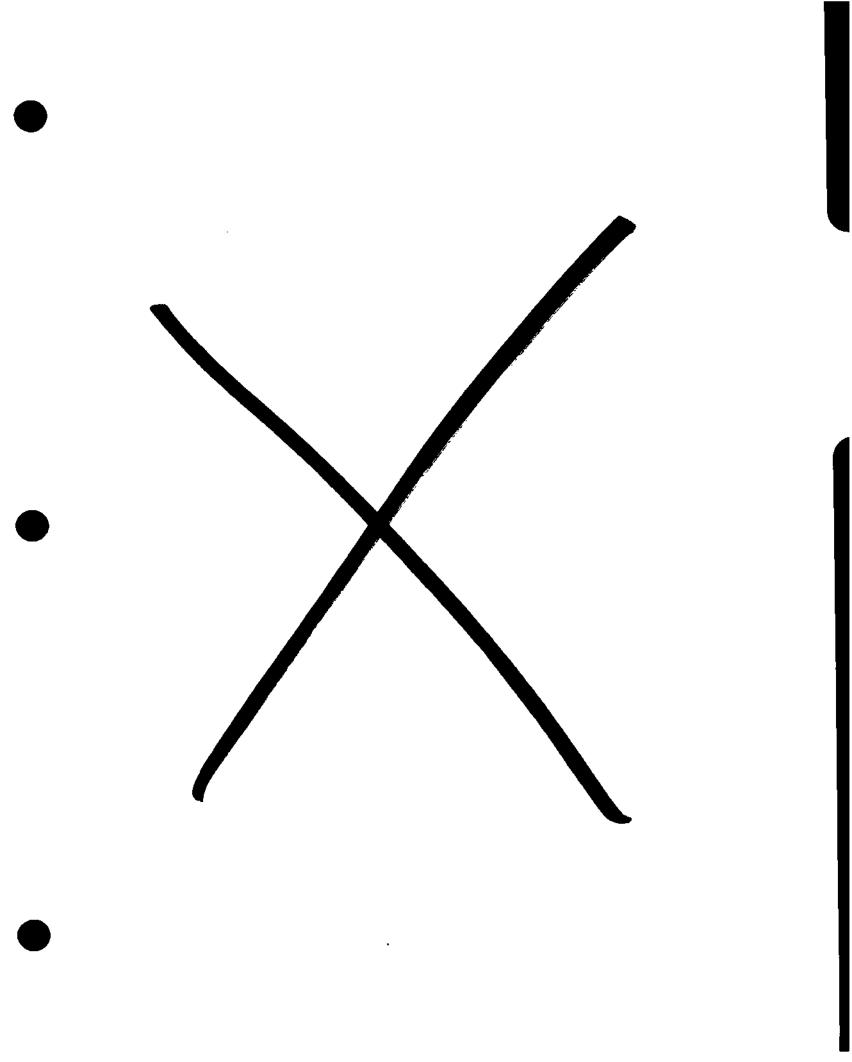
September 1989

Table 15

4Mb EPROM Market Shares (Percentages)

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

Source: Dataquest



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

	MOS	1st	2nd	1988 3rd	4th	
Company	Process	Qtr.	Qtr.	Qtr.	Qtr.	Year
AMD	N	275	345	356	300	1,276
Cypress	С	300	375	325	300	1,300
Intel	N	200	200	175	175	750
National Semi.	С	280	300	320	300	1,200
NEC	N	5	: 10	0	5	20
SGS-Thomson	N	7 9 0	1,040	710	500	3,040
	С	30	35	30	30	125
Texas Instruments	N	85	70	30	25	210
	С	55	50	75	80	260
WaferScale Integ.	С	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 fi	rom					
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
			198	8 Market S	Share	
		1st	2nd	3rd	4th	
		Qtr.	Qtr.	Qtr.	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

_	MOS	1st	2nd	1989 3rd	4th	
Company	Process	Qtr.	Qtr.	Qtr.	Qtr.	Year
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
	С	60	30	10	0	100
Texas Instruments	N	5	5	5	0	15
	С	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 S	Share	
		1st	2nd	3rd	4th	
		Qtr.	Qtr.	Qtr.	Qtr.	Үеаг
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%
					Sou	rre: Dataquest

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	0.030
	С	0	ŏ	ŏ	0	. 0
Hitachi	N	0	Ō	ŏ	0	0
ICT .	C	6	12	12	16	46
Intei	N	1,250	1,250	1,200	1,000	4,700
	N OTP	0	0	0	0	0
Mitsubishi	N	0	0	Õ	ő	ŏ
National Semi.	С	1,000	1,000	1,000	1,000	4,000
NEC	N	10	20	0	0	30
Ricoh	C	0	0	ō	ŏ	0
SGS-Thomson	N	890	630	510	470	2,500
	С	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
	С	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	l	23%	(4%)	(11%)	(12%)	
Cumulative Total		266,543	270,860	274,712	278,114	
ASPs:	NMOS CMOS Overall	\$3.45 \$3.70 \$3.51	\$3.50 \$3.75 \$3.56	\$3.55 \$3.85 \$3.63	\$3.65 \$4.00 \$3.76	\$3.53 \$3.83 \$3.60
Revenue (\$M)		15.8	15.4	14.0	12.8	57.9
. <u>\$</u> :					7-7-10	37.5
		_		Market S	hare	
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Year
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	1st Qtr.	2nd Qtr.	1989 3rd Qtr.	4th Qtr.	Year
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	С	0	0	0	0	0
SGS-Thomson	N	500	500	670	700	2,370
	С	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
•	С	1,021	955	1,015	850	3,841
Total		3,544	3,472	3,498	3,143	13,657
Percentage Change from Previous Quarter	ı	4%	(2%)	1%	(10%)	
Cumulative Total		281,658	285,130	288,628	291,771	
ASPs:	NMOS CMOS Overall	\$3.50 \$3.70 \$3.56	\$3.00 \$3.00 \$3.00	\$2.80 \$2.60 \$2.74	\$2.50 \$2.30 \$2.45	\$2.98 \$2.92 \$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% s _o	100.0%

urce: 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
	С	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
	С	100	100	70	80	350
Goldstar	С	25	´ 80	100	100	305
	C 35ns	S	2	15	28	45
Hitachi	N	0	0	0	275	275
	С	0	0	0	0	0
**	C OTP	0	0	0	0	Ö
Hyundai	С	800	600	200	0	1,600
ICT	С	11	16	19	23	69
Intel	N	2,100	2,400	2,000	2,300	8,800
	С	250	250	250	580	1,330
.	C OTP	150	400	400	600	1,550
Microchip Tech.	С	509	375	554	400	1,838
3.61	C OTP	100	96	150	150	496
Mitsubishi	N	1,200	1,000	1,000	800	4,000
3.6	N OTP	300	300	200	160	960
Motorola	N	0	0	0	0	0
NT	N OTP	0	0	0	0	0
National Semi.	С	2,850	2,600	2,300	2,200	9,950
NEC	N	0	0	0	0	0
	С	200	100	150	40	490
Ott	C OTP	50	50	50	40	190
Oki	· N	100	125	115	120	460
Dinak	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
Ch	C OTP	100	100	150	400	750
Sharp	C	45	35	60	60	200
Signetics	С	1,200	1,700	1,900	1,200	6,000
•	•,					(Continued)

Table 3 (Continued)
64K MOS EPROM Shipment Data, 1988 and 1989

				1988		
Company	MOS Process	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Year
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.	С	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	3 Market S	Share	
		1st	2nd	3rd	4th	
		Qtr.	Qtr.	Qtr.	Qtr.	Year
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

				1989		
	MOS	1st	2nd	3rd	4th	
Company	Process	Qtr.	Qtr.	Qtr.	Qtr.	Year
AMD	N	92 5	634	367	194	2,120
	C 55ns	89	209	705	701	1,704
Atmel	C 45ns	10	10	10	10	40
Cypress	С	200	142	133	125	600
Fujitsu	N	0	0	0	0	0
•	C	0	, 0	0	0	0
Goldstar	С	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	С	0	0	0	0	0
ICT	C	23	30	35	68	156
Intel	N	1,800	1,800	1,800	1,600	7,000
	С	330	330	281	279	1,220
·	C OTP	370	352	300	300	1,322
Microchip Tech. Inc.	С	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.	С	3,000	2,550	2,000	2,200	9,750
NEC	N	0	0	0	0	0
	С	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	С	0	0	0	0	0
SEEQ	N	138	125	118	100	481
Seiko-Epson	С	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

	MOS	1st	2nd	1989 3rd	4th	
Company	Process	Qtr.	Qtr.	Qtr.	Qtr.	Year
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.	С	160	190	190	180	720
	N	7,258	7,264	6,355	5,649	26,526
	С	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	n	(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 S	Share	
		1st	2nd	3rd	4th	
		Qtr.	Qtr.	Qtr.	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% Sou	100.0%

ource: Dataquest May 1990

Table 4

128K MOS EPROM Shipment Data, 1988 and 1989

	!	,	,	1988		
i	MOS	İst	2nd	3rd	4th	;
Company	Process	Ç.	Qtr.	O ff:	Çţ	Year
AMD	N 150ns	1,800	2,500	1,700	1,384	7,384
	C 55ns	0	0	0	0	0
Catalyst	N OTP	0	0	10	15	25
Fujitsu	Z	006	1,100	875	700	3,575
•	Ü	700	870	200	240	2,610
Hitachi	Z	400	4 .	300	300	1,400
Intel	'n	2,200	2,600	2,400	2,600	9,800
	N OTP	100	150	100	200	450
	ပ	300	700	300	90c	1,100
	c otp	0	S	20	20	150
Microchip Tech. Inc.	Ü	469	1,113	1,100	1,200	3,882
	C OTP	256	303	321	320	1,230
Mitsubishi	Z	1,200	006	006	280	3,580
	v	150	250	150	9	650
	N OTP	200	150	100	90	550
		0	0	0	0	0
National Semi.	ပ	370	360	220	200	1,150
NEC	Z	300	909	190	170	1,260
Oki	Z	100	<u>8</u>	110	120	430
	N OTP	250	275	240	260	1,025
SEEQ	Z	20	25	0	0	75
Seiko-Epson	Z	0	0	0	0	0
SGS-Thomson	Z	1,980	2,490	3,180	3,300	10,950
Texas Instruments	Z	100	8	100	100	400
	U	1,800	2,000	1,800	1,000	9,600
	C OTP	20	2	150	100	340
Toshiba		009	550	200	450	2,100
	N OTP	700	650	550	200	2,400
WaferScale Integ.	ņ	20	70	25	30	95
	Z	10,880	12,590	11,255	10,679	45,404
	ပ	4,085	5,236	4,616	3,870	17,807
Total		14,965	17,826	15,871	14,549	63,211

Continued

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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 CMOS Overall	\$3.85 \$4.40 \$4.00	\$3.90 \$4.45 \$4.06	\$3.95 \$4.50 \$4.11	\$4.10 \$4.55 \$4.22	\$3.95 \$4.47 \$4.10
Revenue (\$M)	•	59.9	72.4	65.2	61.4	258.9
			1988	3 Market S	Share	
:		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Year
United States Japan Europe		50.0% 36.8 13.2	53.2% 32.8 14.0	52.1% 27.8 20.0	51.1% 26.3 22.7	51.7% 31.0 17.3
Total		100.0%	100.0%	100.0%	100.0%	100.0%

Table 4 (Continued)

128K MOS EPROM Shipment Data, 1988 and 1989

	SOM	ţ	Ţ L	1989 3rd	4	
Company	Process	Ott.	ğ.	Ott.	Off.	Year
AMD	N 150ns	1,079	946	465	200	2,690
		223	644 4	1,066	1,867	3,800
Atmel	C 120ns	က	ଛ	47	52	132
Catalyst	N OTP	25	35	40	40	140
Fujitsu	Z	800	700	902	909	2,800
	ن ن	520	.510	200	400	1,930
Hitachi	Z	300	250	250	250	1,050
Intel	Z	2,500	2,400	2,100	2,040	9,040
	N OTP	0	0	0	0	0
	ပ	420	380	350	325	1,475
	C OTP	75	95	8	82	345
Microchip Tech. Inc.	ပ	531	529	470	423	1,953
	C OTP	350	427	420	425	1,622
Mitsubishi .	Z	300	320	200	200	1,650
	ບ	96	100	100	8	380
	Z OTP	96	8	8	20	320
	COTP	0	0	0	0	0
National	ບ	280	300	270	240	1,090
NEC	Z	300	9	8	0	460
Oki	Z	4	20	20	20	160
•	N OTP	320	130	ક્ર	9	570
SEEQ	Z	0	0	0	0	0
Seiko-Epson	Z.	0	0	0	0	0
SGS-Thomson	Z	096	1,290	1,620	1,390	5,260
	N OTP	0	4	140	150	330
Texas Instruments	Ż	210	220	1 4 0	120	069
	ပ	1,800	2,000	2,300	2,300	8,400
	C OTP	200	300	9	\$	1,300
Toshiba		250	220	160	<u>8</u>	730
	N OTP	150	150	150	001	550
WaferScale Integ.	ບ	45	55	70	20	240
	Z	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

(Condensed)

Table 4 (Continued)

128K MOS EPROM Shipment Data, 1988 and 1989

•				1989		
Company	MOS Process	1st Qtr.	2nd Qtr.	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 CMOS Overall	\$3.85 \$4.10 \$3.93	\$3.40 \$3.50 \$3.44	\$2.90 \$3.00 \$2.94	\$2.60 \$2.60 \$2.60	\$3.24 \$3.22 \$3.23
Revenue (\$M)		46.8	42.4	37.2	32.1	158.4
			1989	Market i	Share	
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Year
United States Japan Europe		65.3% 26.6 8.1	67.9% 21.3 10.8	65.3% 20.8 14.0	69.7% 17.8 12.5	67.0% 21.6 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
	С	250	300	720	1,127	2,397
Atmei	С	45	51	50	54	200
Catalyst	N OTP	0	0	25	50	75
Cypress	С	0	Ō	0	0	ő
Fujitsu	N	1,000	1,100	1,000	1,000	4,100
	С	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
	С	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
O1 :	C	900	1,200	1,000	1,000	4,100
Oki	N	120	105	110	80	415
Dii	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
Cianation	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

				1988		
	MOS	1st	2nd	3rd	4th	\$7
Company	Process	Qtr.	Qtr.	Qtr.	Qtr.	Year
Toshiba	N	900	. 750	660	500	2,810
	С	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.	С	100	· 125	180	200	605
	N	14,845	· 15,595	14,060	13,120	57,620
	С -	16,515	18,661	20,770	22,743	78,689
Total		31,360	34,256	34,830	35,863	136,309
Percentage Change fr Previous Quarter	om	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	3 Market	Share	
		1st	2nd	3rd	4th	
		Qtr.	Qtr.	Qtr.	Qtr.	Year
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%

Table 5 (Continued)

256K MOS EPROM Shipment Data, 1988 and 1989

		•		1989	777	
	MOS	Ist	2nd	Srd	4th	ļ
Company	Process	Qtr.	Otr.	Otr.	Qt.	Year
AMD		828	746	365	144	2,113
	C 55ns	1,231	1,795	3,247	4,726	10,999
Atmel	- •	950	908	590	645	2,985
Catalyst	N OTP	50	4 8	52	55	205
Cypress	C	7	4	7	∞	20
Fujitsu	Z	1,100	1,100	1,100	1,100	4,400
	C	3,200	3;200	3,200	3,200	12,800
Hitachi	Z	0	0	0	0	0
	O	006	800	<u>00</u> 8	800	3,300
	C OTP	300	300	300	300	1,200
Intel	Z	4,400	4,300	4,100	3,900	16,700
	C	086	1,000	1,000	1,000	3,980
	N OTP	200	550	400	320	1,800
		300	250	98	250	1,100
Microchip Tech. Inc.	Z	200	431	422	391	1,744
	ပ	1,662	1,421	1,789	2,079	6,951
	C OTP	850	815	1,225	1,625	4,515
Mitsubishi	Z	400	350	350	200	1,300
	Ü	1,100	1,000	1,000	1,000	4,100
	N OTP	20	30	20	20	120
	C OTP	700	700	1,000	1,200	3,600
National Semi.	ပ	3,300	3,200	3,041	4,100	13,641
NEC	Z	100	100	50	0	250
		800	906	906	<u>8</u>	3,500
	C OTP	0	0	0	O	0
Oki		4	30	දි	20	120
	N OTP	270	170	160	100	700
Ricoh	U	0	0	0	0	0
SEEQ	ပ	06	8	70	9	300
Seiko-Epson	Ç	0	140	130	130	400
SGS-Thomson	Z	2,000	2,450	2,900	2,600	9,950
		350	220	909	006	2,400
	N OTP	0	ς Ω	150	450	650
	_	100	200	350	320	000,1
Signetics		1,220	1,420	1,700	2,100	6,440
	C OTP	400	8	1,300	1,800	4,400
		,				(Continued)

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

Company	MOS Process	1st Qtr.	2nd Qtr.	1989 3rd Qtr.	4th Qtr.	Year
Sharp .	С	50	50	80	80	260
	C OTP 90ns	50	50	50	50	200
Texas Instruments	С	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
	С	500	400	400	300	1,600
	N OTP	400	300	200	150	1,050
	C OTP	600	600	600	800	2,600
WaferScale Integ.	С	100	125	180	220	- 625
	N	11,068	10,955	10,549	9,730	42,302
	С	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	om	(4%)	4%	8%	10%	
Cumulative Total		383,554	419,309	457,917	500,570	
ASPs:	NMOS CMOS	\$4.20 \$4.50	\$3.50 \$3.70	\$3.00 \$3.10	\$2.70 \$2.70	\$3.40 \$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	1st Qtr.	2nd Qtr.	1988 3rd Qtr.	4th Qtr.	Year
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
	С	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	С	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
	С	0	30	120	300	450
	C OTP	0	0	40	60	100
WaferScale Integ.	С	S	50	55	70	175
	N	8,405	8,575	7,545	7,863	32,388
	С	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

		1st Qtr.	1988 2nd Qtr.	Market 3rd Qtr.	Share 4th Qtr.	Year
United States Japan Europe		37.5% 57.9 4.6	40.7% 51.7 7.6	43.3% 48.7 8.0	44.7% 44.7 10.6	41.7% 50.4 7.9
Total		100.0%	100.0%	100.0%	100.0%	100.0%
Company	MOS Process	1st Qtr.	2nd Qtr.	1989 3rd Qtr.	4th Qtr.	Year
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	С	2,100	2,200	2,200	2,200	8,700
Hitachi	N	150	120	70	70	410
	С	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.	С	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
	С	0	0	0	400	400
Signetics	C	S	75	325	600	1,000
-	C OTP	S	50	150	300	500
Texas Instruments	С	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	1st Qtr.	2nd Qtr.	1989 3rd Qtr.	4th Qtr.	Year
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.	С	85	110	130	150	475
	N	8,057	7;901	7,360	6,884	30,202
	С	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 S	Share	r
		1st	2nd	3rd	4th	
		Qtr.	Qtr.	Qtr.	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					Sou	rce: Dataquest May 1990

Table 7
1-Mbit MOS EPROM Shipment Data, 1988 and 1989

Company	Technology	Max. Acc.T.	Features	1st Qtr.	2nd Qtr.	1988 3rd Qtr.	4th Qtr.	Year
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	\$	40	80	120
NEC	CMOS ·		x8	280	160	370	420	1,230
	CMOS		x16	100	80	240	150	<i>5</i> 70
Oki	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
	С			1,360	1,655	2,670	3,631	9,316
Total				1,540	1,845	2,920	4,281	10,586
Percentage Cha Previous Qua				61%	20%	58%	47%	
_								
Cumulative To	tal			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

			•	1st Qtr.	1988 2nd Qtr.	Market 3rd Qtr.	Share 4th Qtr.	Year
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	1st Qtr.	2nd Qtr.	1989 3rd Qtr.	4th Qtr.	Year
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
	CMOS		x16	250	250	250	250	1,000
Oki	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 Texas	CMOS	200ns	x16	S	0	5	20	25
Instruments	CMOS	150ns	x16	0	10	55	200	265 (Continued)

Table 7 (Continued)

1-Mbit MOS EPROM Shipment Data, 1988 and 1989

Company	Тесhnology	Max. Acc.T.	Features	1st Qtr.	2nd Qtr.	1989 3rd Qtr.	4th Qtr.	Year
Toshiba	CMOS		x8	600	800	900	700	3,000
	CMOS	150ns	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 Ch	ange from							
Previous Qua	arter			60%	30%	(3%)	16%	
Cumulative To	otal			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	
				1st	2nd	3rd	4th	
				Qtr.	Qtr.	Qtr.	Qtr.	Үеаг
United States				24.3%	29.5%	31.8%	39.0%	31.8%
Japan				74.4	68.1	64.7	56.9	65.2
Еигоре				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	e: Dataquest May 1990

Table 8
2-Mbit MOS EPROM Shipment Data, 1988 and 1989

Company	MOS Process	Technology Features	1st Qtr.	2nd Qtr.	1988 3rd Qtr.	4th Qtr.	Year
NEC	CMOS	x8 150ns	NA	NA	s	40	40
Total			0	0	0	40	40
Percentage C Previous Qu			0	0	0	0	
Cumulative 7	otal		0	· · 0	0	40	
ASPs:	CMOS						0
Revenue (\$M	()		0	0	0	0	0
				1988	Market S	Share	
			1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Year
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

Table 8 (Continued)
2-Mbit MOS EPROM Shipment Data, 1988 and 1989

					1989		
Company	MOS Process	Technology Features	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Year
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 C Previous Qu							
Cumulative ?	Total .		100	200	408	746	
ASPs:		•	\$55.00	\$40.00	\$35.00	\$25.00	\$33.82
Revenue (\$M	1)		5.5	4.0	7.3	8.5	25.2
				198	9 Market	Share	
			1st	2nd	3rd	4th	
			Qtr.	Qtr.	Qtr.	Qtr.	Year
United States	3		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						Sou	roe: Dataquest May 1990

Table 9
4-Mbit MOS EPROM Shipment Data, 1988 and 1989

Company	MOS Process	Technology Features	1st Qtr.	2nd Qtr.	1988 3rd Qtr.	4th Qtr.	Year
- •	CMOS	w0	NA	NA	NA	NA	0
Fujitsu	CMOS	x8					0
Intel	CMOS	x16 90ns	NA	NA	NA	NA	0
NEC	CMOS	x8 150ns	NA	ŇΑ	NA	`S	0
Toshiba	CMOS	x8 120ns	NA	NA	NA	S	0
Total			0	0	0	0	0
Percentage C	hange from			•			
Previous Qu				0	0	0	
Cumulative 7	Total		0	0	0	0	
ASPs:			0	0	0	0	0
Revenue (\$M	f)		0	0	0	0	0

		1988 Market Share					
	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Year		
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		

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	Sí	4	12	22	38
Toshiba	CMOS	x8 150ns	. 0	0	10	20	30
Total			0	4	27	68	99
Percentage C Previous Qu							
Cumulative T	otal		. 0	4	31	99	
ASPs:	Overall		\$100.00	\$80.00	\$64.00	\$50.00	\$55.03
Revenue (\$M	D		0	0.3	1.7	3.4	5.4
		•		198	9 Market	Share	
			1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Year
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						Sou	ros: Dataquest May 1990

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.

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Table 1

8K MOS EPROM Shipment Data, 1976-1985

			1976						
	lst	2nd	3rd	4th.					
Company	Otr.	Otr.	Otr.	Otr.	<u>Year</u>				
AMD				_	_				
Electronic Arrays	N/A	N/A	N/A	S	\$				
Fairchild	N/A	N/A	N/A	N/A	N/A				
Fujitsu	N/A	N/A	N/A	\$	S				
Intel	\$	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	A/N	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	<u>s</u>	_20	<u>50</u>	<u>70</u>				
Total	S	25	95	180	300				
Percentage Change from									
Previous Quarter	101	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				
			1976						
	lst	2nd	3rd	4th					
	Otr.	Otr.	Otr.	Otr.	<u>Year</u>				
Market Share									
u.s.	0	100.0%	78.9%	72.2%	76.7%				
Japan	0	0	21.1	27.8	23.3				
Europe	Q	0	0	0	0				
Total	0	100.0%	100.0%	100.0%	100.0%				

N/A = Not Available S = Sampling

Table 1 (Continued)

8K MOS EPROM Shipment Data, 1976–1985

			1977						
	lst	2nd	3rd	4th	-				
Company	Otr.	Otr.	Otr.	Otr.	<u>Year</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	\$	15	20	35	70				
National Semi.	8	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>	300	<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				
			1977						
	lst	2nd	3rd	4th					
	Otr.	Otr.	Otr.	Otr.	<u>Year</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	0	0	0	0	0				
Total	100.0%	100.0%	100.0%	100.0%	100.0%				

N/A = Not Available S = Sampling

(Continued)

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Table 1 (Continued)

8K MOS EPROM Shipment Data, 1976-1985

			1978						
	lst	2nđ	3rd	4th	_				
Company	Otr.	Otr.	Otr.	Otr.	<u>Year</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> </u>	10	30	40				
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				
			1978						
	lst	2nd	3rd	4th					
	Otr.	Otr.	Otr.	Otr.	Year				
Market Share									
v.s.	93.8%	90.8%	88.5%	90.0%	90.5%				
Japan	6.2	9.2	11.5.	10.0	9.5				
Europe	0	0	0	0	0				
Total	100.0%	100.0%	100.0%	100.0%	100.0%				

N/A = Not Available

(Continued)

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SIS Memories 0003780

Table 1 (Continued)

8K MOS EPROM Shipment Data, 1976–1985

			1979					
	lst	2nd	3rđ	4th				
Company	Otr.	Otr.	Otr.	Otr.	<u>Year</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	<u> 100</u>	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			
			_1979					
	lst	2nd	3rd	4th				
	Otr.	<u>Otr.</u>	Otr.	Otr.	<u>Year</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

Table 1 (Continued)

8K MOS EPROM Shipment Data, 1976–1985

			1980 _					
	lst	2nd	3rd	4th				
Company	Otr.	Otr.	Otr.	Otr.	<u>Year</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	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					
	lst	2nd	3rd	4th	,			
	Otr.	Otr.	Otr.	Otr.	<u>Year</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	0	0	0	0	0			
Total	100.0%	100.0%	100.0%	100.0%	100.0%			

N/A = Not Available
S = Sampling

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

			1981						
	lst	2nd	3rđ	4th	_				
Company	Otr.	Otr.	Otr.	Otr.	<u>Year</u>				
AMD	500	200	200	190	1,090				
Electronic Arrays	0	0	O C	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	0	0	0	0	0				
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				
			1981						
	lst	2nd	3rd	4th	_				
	Otr.	Otr.	Otr.	Qtr.	<u>Year</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	0	0	0	0	0				
Total	100.0%	100.0%	100.0%	100.0%	100.0%				

(Continued)

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Table 1 (Continued)

8K MOS EPROM Shipment Data, 1976-1985

			1982		_
	lst	2nd	3rđ	4th	
Company	Otr.	Otr.	Otr.	Otr.	<u>Year</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	0	0	0	0	0
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
			1982		
	lst	2nd	3rđ	4th	-
	Otr.	Otr.	Otr.	Otr.	<u>Year</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	0	0	0	0	0
Total	100.0%	100.0%	100.0%	100.0%	100.0%

Table 1 (Continued)

8K MOS EPROM Shipment Data, 1976-1985

			1983		
	lst	2nd	3rd	4th	
Company	Otr.	Otr.	Otr.	Otr.	<u>Year</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> </u>	0	0	_0	0
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
			1983		
	lst	2nd	3rd	4th	
	Otr.	Otr.	Otr.	Otr.	<u>Year</u>
Market Share					
v.s.	100.0%	100.0%	100.0%	100.0%	100.0%
Japan	0	0	o ·	0	0
Europe	0	0	0	0	0
Total	100.0%	100.0%	100.0%	100.0%	100.0%

Table 1 (Continued)

8K MOS EPROM Shipment Data, 1976–1985

			1984		
	lst	2nd	3rd	4th	
<u>Company</u>	<u>Qtr.</u>	Otr.	Otr.	Otr.	<u>Year</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>	0	0	0	0
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> </u>		1984		
	lst	2nd	3rd	4th	
	Otr.	Otr.	Otr.	Otr.	<u>Year</u>
Market Share					
v.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%

Table 1 (Continued)

8K MOS EPROM Shipment Data, 1976-1985

	_		1985		
	lst	2nd	3rd	4th	
Company	Otr.	Otr.	Otr.	Otr.	<u>Year</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	_0	<u>_Q</u> .	<u>o,</u>	Q	_0
Total	15	10	5	5	35
Percentage Change from	(05)	(000)	(500)	•	
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
			1985		
	lst	2nd	3rd	4th	
	Otr.	Otr.	Otr.	Otr.	<u>Year</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%

Source: Dataquest

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Table 2
16K MOS EPROM Shipment Data, 1976–1987

				1976		
	MOS	lst	2nd	Эrd	4th	
Company	Process	Otr.	Otr.	Otr.	Otr.	<u>Year</u>
AMD	Я	N/A	N/A	N/A	N/A	N/A
Eurotechnique	c	N/A	N/A	N/A	N/A	N/A
Pairchild	N	N/A	N/A	N/A	N/A	N/A
Pujitsu	N	N/A	N/A	N/A	N/A	N/A
Bitachi	N	N/A	N/A	N/A	N/A	N/A
Intel	N	N/A	N/A	s	10	10
Mateushita	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	R/A	N/A	N/A
National Semi.	N	N/A	N/A	N/A	N/A	N/A
	Ç	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	٥	0	0	15	15
	С	0	0	0	0	0
Total		0	0	0	15	15
Percentage Change from						
Previous Quarter						
Cumulative Total		0	0	٥	15	
ASPs: NMOS		\$50.00	\$50.00	\$50.00	\$50.00	\$50.00
CMOS		0	0	0		0
Overall		\$50.00	\$50.00	\$50.00	\$50.00	\$50.00
Revenue (\$M)		٥	0	0	0.8	0.8
				1976	_	
		lst	2nd	3rd	4th	
		Otr.	Otr.	Qtr.	Otr.	Year
Market Share						
v.s.		G	0	0	100.04	100.0%
Japan		0	0	0	0	0
Europe		ö	<u>0</u>	ō	 0	0
Total		0	0	0	100.00	100.0%
S = Sampling						Δ.
N/A = Not Available						

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

				1977		
	MOS	lst	2nd	3rd	4th	
Company	Process	Otr.	<u>Otr.</u>	<u>Otr.</u>	Otr.	Year
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	И	N/A	N/A	N/A	N/A	N/A
Synert e k	N	N/A	N/A	N/A	N/A	N/A
Texas Instruments	N	20	25	30	55	130
Toshiba	И	N/A	<u>N/A</u>	<u>N/A</u>	<u>N/A</u>	<u>N/A</u>
	N	60	100	130	180	470
	c	0	0	0	0	0
Total		60	100	130	180	470
Percentage Change from	ı					
Previous Quarter		0	679	30%	38%	
Cumulative Total		75	175	305	485	
ASPs: NMOS		\$45.00	\$45.00	\$30.00	\$30.00	\$35.11
CMOS		0	0	C	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
				1977		
		lst	2nd	3rd	4th	
		Otr.	Otr.	Otr.	Otr.	Year
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%	100.04	100.0%	100.0%	100.0%

N/A = Not Available

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

				1978		
	MOS	lst	2nd	3ra	4th	
Company	Process	Otr.	Otr.	Otr.	Otr.	Year
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	Ď
Mitsubishi	N	N/A	N/A	N/A	N/A	0
Mostek	N	\$	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	И	N/A	N/A	N/A	N/A	0
Synertek	N	N/A	N/A	N/A	N/A	0
Texas Instruments	Ŋ	100	250	200	300	850
Toshiba	N	N/A	<u>N/A</u>	_ <u>s</u>	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		948	86%	(28%)	95%	
Cumulative Total		835	1,485	1,950	2,855	
ASPs: NMOS CMOS		\$28.00 0	\$25.00 0	\$25.00 0	\$15.00 0	\$21.62 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		
		lst	2nd	3rd	4th	
·		Otr.	Otr.	Otr.	Otr.	Year
Market Share						
U.S.		100.0%	100.0%	98.94	95.6%	98.1%
Japan		0	0	1.1	4.4	1.9
Europe		0	0	0	0	0
Total		100.04	100.0%	100.0%	100.04	100.04

S = Sampling N/A = Not Available

Table 2 (Continued)

16K MOS EPROM Shipment Data, 1976–1987

				1979		
	MOS	lst	2nd	3rd	4th	
Company	Process	Otr.	Otr.	Otr.	Otr.	<u>Year</u>
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.	И	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	R/A	0
SGS-Ates	N	N/A	N/A	N/A	N/A	Đ
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
	С	0	0	0	0	0
Total		1,435	2,470	3,165	4,475	11,565
Percentage Change from						
Previous Quarter		59€	728	29%	414	
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		
		lst	2n₫	3rd	4th	
•		Otr.	Otr.	Otr.	Otr.	<u>Year</u>
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
Entobe		0	<u>C</u>	0		
Total		100.0%	100.04	100.0%	100.0	100.0%

S = Sampling N/A = Not Available

Table 2 (Continued)

16K MOS EPROM Shipment Data, 1976–1987

				1980		_
	MOS	lst	2nd	3rd	4th	
Company	Process	Otr.	Ott.	Otr.	Otr.	Year
AMD	N	25	50	100	175	350
Eurotechnique	c	N/A	N/A	N/A	N/A	C
Fairchild	N	30	300	300	250	880
Fujitsu	и	350	750	700	650	2,450
Hitacni	Ŋ	700	850	1,025	1,325	3,900
Intel	N	950	1,000	1,700	1,850	5,500
Matsushita	N	S	50	50	60	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
	С	N/A	N/A	N/A	N/A	0
NEC	N	10	25	50	125	210
Oki Electric	Ħ	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
				1980		
		lst	2nd	3rd	4th	
		Otr.	Otr.	Otr.	Otr.	Year
Market Share						
v.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	<u>6.0</u>
Total		100.0%	100.0%	100.0%	100.01	100.0%

S = Sampling N/A = Not Available

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

Table 2 (Continued)

16K MOS EPROM Shipment Data, 1976-1987

				1981		
	MOS	lst	2nd	3rá	4th	
Company	Process	Otr.	Otr.	Otr.	Otr.	<u>Year</u>
AMD	N	250	350	485	750	1,835
Eurotechnique	Ċ	N/A	N/A	S	15	15
Pairchild	N	100	20	20	0	140
Pujitsu	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
Miteubishi	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	<u>740</u>
	N	10,205	11,445	11,305	11,645	44,600
	С	0	0	0	15	<u> 15</u>
Total		10,205	11,445	11,305	11,660	44,615
Percentage Change from						
Previous Quarter		174	124	(1%)	3*	
Cumulative Total		54,915	66,360	77,665	8 9 ,325	
ASPs: NMOS		\$4.50	\$3.50	\$3.00	\$2.50	\$3.34
CMOS		Û	0	0	O	0
Overall		\$4.50	\$3.50	\$3.00	\$2.50	\$3.34
Revenue (\$M)		45.9	40.1	33.9	29.1	149.0
				1981		
		lst	2nd	3tg	4th	
		Otr.	Otr.	Otr.	Otr.	<u>Year</u>
Market Share						
U.\$.		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.

Table 2 (Continued)

16K MOS EPROM Shipment Data, 1976–1987

				1982		
	MOS	lst	2nd	3rd	4th	
Company	Process	Otr.	Otr.	Otr.	Otr.	Year
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
Pujitsu	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
	С	50	150	200	200	600
NEC	И	900	1,000	1,200	1,200	4,300
Oki Electric	N	250	400	400	400	1,450
SGS-Ates	И	100	180	350	520	1,150
Synertek	n	0	0	0	0	0
Texas Instruments	Ŋ	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
	С	150	<u>550</u>	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 CMOS		\$3.25 0	\$3.10 0	\$3.00	\$3.00	\$3.09 0
Overall		\$3.25	\$3.10	\$3.00	\$3.00	\$ 3.09
Revenue (\$M)		36.6	32.4	28.7	28.2	125.7
				1982		
		lst	2nd	310	4th	
		Qtr.	Otr.	Otr.	Otr.	Year
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	<u>5.3</u>	<u>8.3</u>	11.0	<u>6.4</u>
Total		100.0%	100.0%	100.08	100.0%	100.0%

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

Table 2 (Continued)

16K MOS EPROM Shipment Data, 1976–1987

				1983		
	MOS	lst	2nd	316	4th	
Company	Process	Otr.	Otr.	Otr.	Otr.	Year
AMD	N	700	700	1,000	1,200	3,600
Eurotechnique	¢	200	200	200	200	800
Fairchild	n	0	0	0	0	0
Pujitsu	N	50	\$ 0	0	0	100
Hitachi	N	100	100	50	0	250
Intel	и	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
	С	350	500	500	700	2,050
NEC	И	2,000	2,500	2,700	1,500	8,700
Oki Electric	N	400	400	350	350	1,500
SGS-Ates	N	500	600	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
	С	550	<u>700</u>	700	900	2,850
Total		10,180	11,800	12,440	11,730	46,150
Percentage Change from						
Previous Quarter		04	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	2nd	3rd	4th	
		Otr.	Otr.	Otr.	Otr.	Year
Market Share						
v.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	<u>8.5</u>	8.0	9.4	<u>B.2</u>
Total		100.0%	100.00	100.0%	100.0%	100.0%

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

Table 2 (Continued)

16K MOS EPROM Shipment Data, 1976–1987

				1984		
	MOS	lst	2nd	310	4th	
Company	Process	Otr.	Otr.	Otr.	Otr.	<u>Year</u>
AMD	N	1,000	1,100	1,200	1,300	4,600
Pairchild	N	0	0	0	0	0
Fujitsu	N	0	0	0	0	Ð
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
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	И	1,050	600	300	800	2,750
Synertek	N	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
Toshipa	N	0		<u>o</u>	 0	<u> </u>
	N	10,430	9,180	7,305	6,950	33,865
	С	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%)	(68)	
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		
		lst	2nd	3rd	4th	
		Otr.	Otr.	Otr.	Otr.	<u>Year</u>
Market Share						
U.S.		73.30	75.5%	77.18	73.0%	74.79
Japan		15.7	16.1	16.1	13.2	15.4
Europe		11.0	8.4	<u>6.8</u>	13.8	10.0
Total		100.04	100.0%	100.0%	100.0%	100.04

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

Table 2 (Continued)

16K MOS EPROM Shipment Data, 1976–1987

				1985		
	MOS	lst	2nd	3r å	4th	
Company	Process	Otr.	Otr.	Otr.	Otr.	<u>Year</u>
AMD	И	1,550	1,850	1,350	1,050	5,800
Pairchild	N	0	C	0	0	0
Fujitsu	n	0	O	C	0	0
Hitachi	N	0	0	0	C	0
Intel	19	0	0	0	0	0
Matsushita	N	0	0	0	0	0
Mitsubishi	N	50	50	G	0	100
Mostek	N	0	0	0	٥	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 0	800 0	1,100 0	1,200 D	3,850 0
Synertek	N N	1,500	1,500	1,600	1,600	6,200
Texas Instruments	C	350	450	400	500	1,700
Thomson-Eurotechnique	N			100	0	
Toshida	Ŋ	0	0			
	N	6,200	6,200	6,450	5,420	24,270
	C	<u>750</u>	800	800	1,000	3,350
Total		6,950	7,000	7,250	6,420	27,620
Develope Change from						
Percentage Change from Previous Quarter		(9%)	18	4%	(114)	
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
				1985		
		lst	2nd	3rd	4th	
		Otr.	Otr.	Otr.	Otr.	Year
hautat Chana					•	_
Market Share		75.5%	75.78	66.99	67.8%	71.5%
U.S.		8.6	6.4	12.4	5.8	8.4
Japan Buran			17.9	20.7	26.5	20.1
Europe		15.8	1/.5	20.7	<u> </u>	
Total		100.0%	100.0%	100.0%	100.0	100.0%

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

Table 2 (Continued)

16K MOS EPROM Shipment Data, 1976–1987

		1986					
	MOS	lst	2nd	3rd	4th		
Company	Process	Otr.	Otr.	Otr.	Otr.	<u>Year</u>	
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	
	И	5,036	3,809	3,330	2,490	14,665	
	С	0	0	0	0	<u>o</u>	
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	Đ	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			
		lst	2nd	3rd	4th		
		Otr.	Otr.	Otr.	<u>Otr.</u>	Year	
Market Share							
v.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	<u>33.1</u>	28.4	
Total		100.0%	100.00	100.0	100.0%	100.0%	

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

Table 2 (Continued)

16K MOS EPROM Shipment Data, 1976–1987

				1987		
	ROM	lst	2nd	310	4th	
<u>Company</u>	Process	Otr.	Otr.	Dtr.	Otr.	<u>Year</u>
AMD	N	500	300	300	290	1,390
Cypress	С	150	200	200	350	900
Intel	N	200	200	200	200	600
National Semi.	¢	158	227	204	195	784
NEC	N	40	40	\$ 0	30	160
SGS-Thomson	N	1,185	1,125	1,240	720	4,270
	С	15	70	30	75	190
Texas Instruments	N	200	200	150	150	700
	ç	50	50	110	125	335
WaferScale	С	10	25	<u> 75</u>	75	185
	N	2,125	1,865	1,940	1,390	7,320
	c	383	<u>572</u>	619	820	2,394
Total		2,508	2,437	2,559	2,210	9,714
Percentage Change from						
Previous Quarter		14	(3%)	5%	(14%)	
		260.263	262,700	265,259	267,469	
Cumulative Total		200,263	262,700	265,233	207,409	
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 (SM)		7.2	6.5	7.1	6.5	27.2
				1987	_	
		lst	2n6	3rd	4th	
		Ott.	Otr.	Otr.	Otr.	<u>Year</u>
Market Share						
u.s.		50.6€	49.3%	48.49	62.7%	52.41
Japan		1.6	1.6	2.0	1.3	1.6
Europe		47.8	49.0	49.6	36.0	45.9
Total		100.04	100.01	100.0%	100.0%	100.0%

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

Source: Dataquest May 1989

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

		1978						
	MOS	lst	2nd	3rd	4th			
Company	Process	Otr.	Otr.	Otr.	Otr.	Year		
AMD	N	N/A	N/A	N/A	N/A	0		
Eurotechnique	С	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	A\M	N/A	N/A	0		
National Semi.	c	N/A	N/A	N/A	N/A	0		
NEC	и	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	И	N/A	N/A	N/A	5	5		
Toshiba	N	<u>n/a</u>	<u>N/A</u>	<u>n/a</u>	<u>n/a</u>	0		
	N	0	0	0	5	5		
	c	<u>o</u>	<u>•</u>	<u>o</u>	<u>o</u>	0		
Total		0	0	0	5	5		
Percentage Change fro	on.							
Previous Quarter		0	0	0	0			
Cumulative Total		0	0	0	5			
ASPs: NMOS		o	0	0	0	\$80.00		
CMOS		0	0.	0	0	0		
Overall		0	0	0	0	\$60.00		
Revenue (\$M)		0	0	0	0	0		
				1978				
		lst	2nd	3rd	4th			
		Otr.	Otr.	Otr.	Otr.	<u> 1891</u>		
Market Share								
U.S.		٥	0	0	0	0		
Japan		0	0	0	0	0		
Europe		<u>0</u>	ō	<u>o</u>	<u>o</u>	<u>o</u>		
Total		0	0	0	₹ 0	0		

S = Sampling N/A = Not Available

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

				1979		
	MOS	lst	2nd	3rd	4th	
Company	Process	Qtr.	Otr.	Otr.	Otr.	<u>Year</u>
AMD	и	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	'R	N/A	N/A	N/A	s	0
Intel	N	5	30	50	100	185
Mitsubishi	N	N/A	A/M	N/A	8	0
Motorola	N	N/A	N/A	N/A	5	0
National Semi.	С	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	O.
Rockwell	N	N/A	N/A	N/A	N/A	0
	С	N/A	N/A	N/A	N/A	Đ
SGS-Ates	N	N/A	N/A	N/A	N/A	0
Texas Instruments	, N	10	35	60	90	195
Toshiba	N	<u>n/a</u>	<u> N/A</u>	N/A	N/A	0
	N	15	65	110	190	380
	С	0	0	0	0	
Total		15	65	110	190	380
Percentage Change from			0226	444	50 0	
Previous Quarter		0	3334	698	73%	
Cumulative Total		20	85	195	385	
ASPs: NMOS		\$80.00	\$80.00	\$75.00	\$75.00	\$ 76.05
CMOS		0	0	0	Ō	0
Overalı		\$80.00	\$80.00	\$75.00	\$75.00	\$ 76.05
Revenue (\$M)		1.2	5.2	8.3	14.3	28.9
				1979		
		lst	2nd	3rd	4th	
		Otr.	Otr.	<u>Qtr.</u>	<u>Qtr.</u>	<u>Year</u>
Market Share						
v.s.		100.0%	100.0%	100.00	100.0%	100.0%
Japan		0	0	0	0	0
Europe		0		0	0	0

S = Sampling
N/A = Not Available

Table 3 (Continued)

32K MOS EPROM Shipment Data, 1978-1987

				1980		
	MOS	lst	2nd	3rd	4th	
Company	Process	Otr.	Otr.	<u>Otr.</u>	Otr.	Year
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
	С	N/A	N/A	N/A	N/A	0
Bitachi	N	S	120	220	280	620
Intel	N	165	250	325	450	1,190
Mitsubishi	N	s	6	40	90	136
Motorola	N	5	30	60	50	145
National Semi.	¢	S	10	15	15	40
NEC	N	N/A	N/A	5	15	20
Ricoh	Ç	N/A	N/A	N/A	R/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	<u>N/A</u>	<u>s</u>		10	15
	N	320	706	1,020	1,447	3,493
	Ċ	0	70	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	340.00	\$30.00	\$10.00	\$26.03
CMOS		Û	0	0	0	0
Overall		\$ 55.00	\$40.00	\$30.00	\$10.00	\$26.03
Revenue (\$M)		17.6	26.2	30.6	14.5	90.9
				1980		
		lst	2nô	3rd	4th	
		Otr.	Otr.	Otr.	Otr.	<u>Year</u>
Market Share						
U.S.		100.00	82.4%	72.5%	66.1%	74.48
Japan		0	17.6	27.5	33.9	25.6
Europe				0	0	0
Total		100.0%	100.0%	100.00	100.0%	100.0%

S = Sampling N/A = Not Available

Table 3 (Continued)

32K MOS EPROM Shipment Data, 1978-1987

				<u>1</u> 981		
	MOS	lst	2nd	3rd	4th	
Company	Process	Otr.	Otr.	Otr.	Otr.	<u>Year</u>
AMD	N	10	100	120	310	540
	C	N/A	N/A	120 S		540
Burotechnique				-	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
Mitsubish:	N	190	270	270	660	1,390
Motorola	N	50	120	250	350	770
National Semi.	C	10	20 50	30	30	90
NEC	N C	30		325	700	1,105
Ricoh	N	n/a n/a	n/a n/a	n/a n/a	n/a n/a	0
Rockwell	Č		•	•		0
	N	N/A	N/A	N/A	N/A	0
SGS-Ates	N N	N/A 560	N/A 700	N/A 900	N/A	3,160
Texas Instruments		-			1,000	-
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%	514	
Cumulative Total		6,028	8,783	13,328	20,213	
ASPs: NMOS		\$9.00	\$8.00	\$7.0 0	\$5.80	\$6.92
CMOS		0	0	8	8	O
Overall		\$9.00	\$8.00	\$7.00	\$5.80	\$6.92
Revenue (\$M)		18.9	21.9	31.6	39.7	112.1
				1981		
		lst	2nd	3rd	4th	
		Otr.	Otr.	Otr.	Otr.	Year
Market Share						
v.s.		58.3%	59.5%	51.7%	47.8%	52.2%
Japan		41.7	40.5	48.3	52.1	47.7
Europe		<u>0</u>	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.

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

				1982		
	MOS	lst	2nd	310	4th	
Company	Process	Otr.	Otr.	Otr.	Otr.	<u>Year</u>
AMD	N	600	1,050	650	850	3,150
Eurotechnique	¢	30	100	150	200	480
Pujitsu	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	И	1,300 N/A	1,600 N/A	2,200 N/A	2,300 N/A	7,400 0
Ricoh Rockwell	C N	N/A N/A	N/A N/A	N/A N/A	N/A N/A	0
KOCKASII	Ç	N/A	N/A	N/A	N/A	ő
SGS-Ates	й	Š	10	25	50	85
Texas Instruments	N	500	600	700	900	2,700
Toshipa	N	300	400	600	600	1,900
TOBILIDE			400			
	ĸ	8,575	10,960	12,075	12,400	44,010
	С	105	200	370	450	1,125
Total		8,680	11,160	12,445	12,850	45,135
Percentage Change from						
Previous Quarter		26%	29%	124	38	
Cumulative Total		28,893	40,053	52,498	65,348	
ASPB: NMOS		\$6.00	\$5.50	\$5.00	\$4.75	\$5.25
CMOS		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		
		lst	2nd	3rđ	4th	
		Otr.	Otr.	Otr.	Otr.	<u>Year</u>
Market Share						
v.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.

Table 3 (Continued)

32K MOS EPROM Shipment Data, 1978-1987

				_1983		
	MOS	lst	2nd	3ra	4th	
Company	Process	Otr.	Otr.	Otr.	Otr.	Year
AMD	N	800	1,000	1,200	1,500	4,500
Eurotechnique	С	200	300	400	400	1,300
Pujitsu	N	1,200	1,500	1,500	1,500	5,700
	С	10	25	50	50	135
Hitachi	и	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	٥	0	0
National Semi.	c	350	450	60 0	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
	С	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	<u>560</u>	775	1,050	1,275	3,660
Total		13,710	15,975	16,250	16,175	62,110
Percentage Change from		78	174	2%	0%	
Previous Quarter		/4	174	46	04	
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		
		lst	2nd	310	4th	
		Otr.	Otr.	Otr.	Otr.	Year
Market Share						
u.s.		33.9%	37.2%	43.1%	47.19	40.6%
Japan		64.3	60.3	53.8	49.8	56.7
Entobe	•	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

Table 3 (Continued)

32K MOS EPROM Shipment Data, 1978–1987

				1984		
	MOS	lst	2na	3rd	4th	
Company	Process	Otr.	<u>Qtr.</u>	Otr.	Otr.	Year
AMD	N	1,600	1,600	2,200	2,200	7,800
Pujitsu	N	1,600	1,800	1,500	1,200	6,100
-	С	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	И	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
	С	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	¢	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%)	14	(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	\$7.0 0	\$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		
		lst	2nd	3rd	4th	
		Otr.	Otr.	Otr.	Otr.	<u>Year</u>
Market Share						
U.S.		51.7%	54.2%	59.0%	58.4%	55.6%
Japan		44.8	41.8	34.7	31.6	36.7
Europe		<u> 3.5</u>	4.1	<u>6.3</u>	10.1	<u>5.7</u>
Total		100.0%	100.0%	100.0%	100.00	100.0%

S = Sampling

N/A * Not Available

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

Table 3 (Continued)

32K MOS EPROM Shipment Data, 1978–1987

	MOS	lst	2nd	3rd	4th		
Company	Process	Otr.	Otr.	Otr.	Otr.	<u>Year</u>	
AMD	И	2,200	2,450	1,750	1,300	7,700	
Pujitsu	N	800	600	300	250	1,950	
	С	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	O	0	0	0	0	
National Semi.	Ċ	700	600	500	500	2,300	
NEC	N	730	500	800	530	2,560	
Ricoh	ċ	150	200	200	150	700	
Rockwell	N	50	50	0	0	100	
	Ċ	Õ	ō	Ď	Ó	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	ċ	350	400	400	400	1,550	
Toshiba	Ň	0	0	Ö	0	0	
10311104		<u>`</u>	<u>`</u>	<u> </u>		<u>_</u>	
	N	9,730	9,100	7,550	6,480	32,860	
	С	1,450	1,450	1,350	1,200	5,450	
Total		11,180	10,550	6,900	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	
				1985			
		lst	2nd	3ra	4th		
						Vost	
		Otr.	Otr.	Otr.	Otr.	<u>Year</u>	
Market Share							
v.s.		56.6%	58.6%	59.0%	58.6%	58.7%	
Japan		31.1	30.B	27.0	23.2	28.5	
<u>Europe</u>		10.3	10.4	14.0	18.2	12.8	
Total		100.0%	100.00	100.0%	100.0%	100.0%	

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

				1986		
	MOS	lst	2nd	3rd	4th	
Company	Process	Otr.	Otr.	Otr.	Otr.	<u>Year</u>
AMD	N	950	850	675	450	2,925
Pujitsu	N	150	50	ø	o	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	Ŋ	0	0	282	7	289
National Semi.	Č.	400	300 270	300 150	300	1,300
NEC	N C	330 50	50	120	100 0	850 100
Ricoh SGS	N	463	350	1,200	1,200	3,213
	N	1,000	1,000	1,100	1,500	4,600
Texas Instruments Thomson-Eurotechnique	Č	300	300	300	300	1,200
Thomson-Ediotecimique	•					47,200
	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 Ouarter		(25%)	(14%)	94	48	
Titaines Section		1-00/	,,,			
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		
		lst	2nd	3rd	4th	
		Otr.	Otr.	Otr.	Otr.	Year
Market Share						
t.s.		67.9%	75.28	62.1%	70.2%	68.7%
Japan		18.8	11.6	9.9	2.0	10.6
Europe		13.3	13.2	28.0	27.0	20.5
Total		100.0%	100.0%	100.00	100.0%	100.0%

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

				1987		
	MOS	lst	2nd	3rd	4th	
Company	Process	Otr.	Otr.	Otr.	Otr.	Year
AMD	N	400	450	475	510	1,835
Pujitsu	N	0	0	0	0	0
	С	0	0	0	0	0
Hit a chi	N	0	0	0	0	0
Intel	N	1,050	1,300	1,100	1,100	4,550
	OTP	0	O	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	Ç.	0	0	0
SGS-Tnomson	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
	С	625	815	794	673	3,107
mana 3		4,560	4,135	3,859	3,653	16,207
Total		4,500	41132	3,033	3,633	10,207
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		
		lst	2nd	3rd	4th	
		Otr.	Otr.	Otr.	Otr.	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%	100.00	100.0%	100.0%	100.04

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

Source: Dataquest May 1989

Table 4

64K MOS EPROM Shipment Data, 1980-1987

		1980					
	MOS	lst	2nd	3rd	4th		
Company	Process	Otr.	Otr.	Otr.	Otr.	<u>Year</u>	
AMD	N	N/A	N/A	N/A	N/A	. 0	
Pujitsu	N	N/A	N/A	N/A	N/A	0	
	С	N/A	N/A	N/A	N/A	0	
Hitachi	N	N/A	N/A	N/A	5	0	
	c	N/A	N/A	N/A	N/A	0	
Intel	N	N/A	N/A	N/A	S	0	
	И	N/A	N/A	N/A	N/A	Đ	
Mitsubishi	И	N/A	N/A	N/A	N/A	Đ	
Mostek	N	N/A	N/A	N/A	S	0	
Motorola	N	S	5	5	5	10	
NEC	N	N/A	N/A	N/A	N/A	0	
	¢	N/A	N/A	A\N	N/A	0	
Oki Electric	N	N/A	N/A	N/A	N/A	0	
Ricoh	Ċ	N/A	N/A	N/A	N/A	0	
Rockwell	N	N/A	N/A	N/A	A/K	0	
	c	N/A	N/A	N/A	N/A	0	
SEEQ	N	A/M	N/A	N/A	N/A	0	
Seiko-Epson	С	N/A	N/A	N/A	N/A	0	
SGS-Ates	N	N/A	N/A	N/A	N/A	Q.	
Sharp	С	N/A	N/A	n/a	N/A	0	
Signetics	¢	N/A	N/A	N/A	N/A	0	
Texas Instruments	N	N/A	s	10	20	30	
Toshipa	n	n/A	N/A	N/A	N/A	0	
VLSI Technology	С	N/A	N/A	N/A	N/A	Đ	
WaferScale	И	<u>N/A</u>	N/A	<u>n/a</u>	<u>N/A</u>	<u> </u>	
	N	0	0	15	25	40	
	c	<u>o</u>	<u>o</u>	_0	_0	_0	
Total		0	0	15	25	40	
Percentage Change from	1		<u></u>				
Previous Quarter		0.	0;	¢	67%		
Cumulative Total		-0.	0	15	40		
ASPs: NMOS		0	0	0	0	0	
CMOS		0	0	0	0	422.75	
Overall		\$200.00	\$100.00	\$80.00	\$70.00	\$73.75	
Revenue (\$M)		0	0	1.2	1.8	3.0	
				1980			
		lst	2nd	3rc	4th		
		<u>Otr.</u>	Otr.	Otr.	Otr.	Year	
Market Share			_				
U.S.		0	0	100.0%	100.00	100.0%	
Japan		0	0	0	0	0	
Europe		<u>o</u>	<u>o</u>	0	0	0	
Total		0	0	100.0	100.0%	100.0%	
S = Sampling N/A = Not Available						(Seugit	

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

		1981					
_	MOS	lst	2nd	3rd	4th		
Company	Process	Otr.	Otr.	Otr.	Otr.	<u>Year</u>	
AMD	n	N/A	N/A	N/A	N/A	0	
Pujitsu	N	s	1	15	100	116	
	Ç	N/A	N/A	N/A	N/A	0	
Hitachi	N	5	2	5	25	32	
·	c	N/A	N/A	N/A	N/A	0	
Intel	n n	10	70	200	500	780	
Mitsubishi	น ห	n/a n/a	N/A N/A	A\K A\K	N/A S	0	
Mostek	N	s s	2	5	3	10	
Motorola	N	15	40	30	50	135	
NEC	N	N/A	N/A	N/A	s		
	c	N/A	N/A	N/A	N/A	0	
Oki Electric	N	N/A	N/A	N/A	N/A	0	
Ricoh	С	N/A	N/A	N/A	N/A	0	
Rockwell	N	N/A	N/A	N/A	N/A	0	
	¢	R/A	N/A	N/A	N/A	0	
SEEQ	N	N/A	N/A	N/A	A\N	0	
Seiko-Epson	C	N/A	N/A	N/A	N/A	0	
SGS-Ates	N	N/A	N/A	N/A	N/A	C	
Sharp	c	N/A	N/A	N/A	N/A	C	
Signetics	C	N/A	N/A	N/A	N/A	0	
Texas Instruments	Ŋ	30	65	100	100	295	
Toshiba	N	N/A	N/A	N/A	N/A	0	
VLSI Technology	C N	N/A	N/A	N/A	N/A	0	
WaferScale	N	<u>N/A</u>	<u>N/A</u>	N/A	<u>N/A</u>	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%	974	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	
				1981 _			
		lst	2nd	3rd	- 4th		
		Otr.	Otr.	Otr.	Otr.	<u>Year</u>	
Market Share							
ນ.ຣ.		100.0%	98.3%	94.48	83.9%	89.2%	
Japan		0	1.7	5.6	16.1	10.6	
Europe		0	<u> </u>	0	0	0	
Total		100.0%	100.0%	100.0%	100.0%	100.0%	
S = Sampling							

S = Sampling N/A = Not Available

Table 4 (Continued)

64K MOS EPROM Shipment Data, 1980-1987

		1982					
	MOS	lst	2nd	3rd	4th		
Company	Process	Otr.	Otr.	Otr.	Otr.	<u>Year</u>	
AMD	N	s	10	250	500	760	
Fujitsu	N	400	1,000	1,500	2,000	4,900	
	C	10	25	50	106	185	
Hitachi	N	100	250	600	800	1,750	
•	¢	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	ю.	S	10	60	200	270	
	C	N/A	N/A	N/A	N/A	0	
Oki Electric	N	A\M	N/A	N/A	S	0	
Ricoh	c	N/A	N/A	N/A	N/A	Û	
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	И	<u> N/A</u>	N/A	<u> N/A</u>	<u> N/A</u>	0	
	N C	1,460	3,185 <u>25</u>	5,635 <u>50</u>	7,665 100	17,945 <u>185</u>	
Total		1,470	3,210	5,685	7,765	18,130	
Percentage Change from							
Previous Quarter		89%	118%	77%	374		
Cumulative Total		2,878	6,088	11,773	19,538		
ASPs: NMOS		0	C	0	0	0	
CNOS		D	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	
				1982			
		lst	2nd	314	4th		
		Otr.	Otr.	Otr.	Otr.	<u>Year</u>	
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

Table 4 (Continued)

64K MOS EPROM Shipment Data, 1980–1987

				1983		
	MOS	lst	2nd	3rd	4th	
Company	Process	Otr.	Otr.	Otr.	Otr.	<u>Year</u>
AMD	N	600	900	1,300	1,800	4,600
Pujitsu	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
	С	A\N	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	
Oki Electric	N	25	50	100	200	375
Ricoh	Ċ	N/A	N/A	N/A	N/A	0
Rockwell	N	N/A	N/A	N/A	N/A	0
	С	N/A	N/A	N/A	N/A	0
Seeq	N	25	100	310	600	1,035
Seiko-Epson	¢	N/A	N/A	N/A	N/A	0
SG5-Ates	N	N/A	N/A	N/A	S	0
Sharp	c	N/A	N/A	N/A	N/A	0
Signetics	С	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	С	N/A	N/A	N/A	N/A	0
WaferScale	И	<u> </u>	<u> N/A</u>	<u> </u>	<u> </u>	0
	N	10,150	13,150	17,760	22,300	63,360
	Ĉ	250	300	400	450	1,400
Total		10,400	13,450	18,160	22,750	64,760
• · · · · · · · · · · · · · · · · · · ·						
Percentage Change from						
Previous Quarter		34%	298	35%	25%	
Cumulative Total		29,938	43,388	61,548	84,298	
ASPs: NMOS		0	0	0	0	0
CMOS		0	0	0	Đ	0
Overall		\$5.50	\$4.75	\$5.00	\$5.50	\$5.20
Revenue (\$M)		57.2	63.9	90.8	125.1	337.0
				1983		_
		lst	2nd	3rd	. 4th	
		Otr.	Otr.	Otr.	Otr.	<u>Year</u>
Market Share						
U.S.		40.1%	40.9%	41.6%	37.8%	39.9%
_		59.9	59.1	58.4	62.2	60.1
Japan Europe		0	0	0	0	0
Total		100.0%	100.0%	100.0%	100.04	100.0%
S = Sampling N/A = Not Available					(Ann	

Table 4 (Continued)

64K MOS EPROM Shipment Data, 1980-1987

				1984	84		
	MOS	lst	2nd	3rå	4th		
Company	Process	Otr.	Otr.	Otr.	Otr.	<u>Year</u>	
AMD	N	1,200	1,300	1,600	1,700	5,800	
Pujitsu	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	
	С	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	Đ	0	o	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	8	0	
Oki Electric	N	400	5 00	500	400	1,900	
Ricoh	С	N/A	0	25	, 100	125	
Rockwell	N	8	10	0	0	10	
	C	10	50	Ò	0	60	
SEEQ	N	800	1,000	1,050	1,100	3,950	
Seiko-Epson	¢	N/A	N/A	N/A	N/A	0	
SGS	N	50	150	350	600	1,150	
Sharp	С	N/A	N/A	N/A	N/A	0	
Signetics	С	\$	10	10	10	30	
Texas Instruments	N	2,400	2,600	2,800	2,400	10,200	
Toshipa	N	400	1,200	800	500	2,900	
VLSI Technology	c	A\M	N/A	N/A	N/A	0	
WaferScale	N	N/A	<u> </u>	<u> N/A</u>	<u> </u>	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%)	214	34	(28)		
Cumulative Total		105,358	130,928	157,263	183,023		
ASPs: NHOS		\$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			
		lst	2nd	3rd	4th		
		Otr.	Otr.	Otr.	Otr.	Year	
Market Share							
D.S.		34.78	30.8%	30.6%	29.91	31.34	
Japan		65.1	66.6	6 8.1	67.7	67.5	
Europe		0.2	0.6	1.3	2.3	<u>1.2</u>	
Total		100.0%	100.00	100.0%	100.00	100.0%	

S = Sampling N/A = Not Available

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

Table 4 (Continued)

64K MOS EPROM Shipment Data, 1980-1987

			1985					
	MOS	lst	2na _	3£d	4th			
Company	Process	<u>Otr.</u>	Otr.	Otr.	Otr.	Year		
AMD	ĸ	2,100	1,550	1.825	1.150	6,625		
Fujitsu	N	3,500	3,500	3,600	3,500	14,300		
10,1100	Ĉ	800	950	1,000	1,200	3,950		
Hitachi	N	5,500	5,200	5,000	4,500	20,200		
	č	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		
	Ċ	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	D		
	C	Ó	Ō	Ō	Ó	Ó		
SEEQ	N	625	500	350	275	1,750		
Seiko-Epson	c	N/A	N/A	N/A	s	. 0		
\$GS	N	880	850	1,000	1,350	4.080		
Sharp	С	N/A	N/A	N/A	S	0		
Signetics	č	0	0	0	ō	ŏ		
Texas Instruments	N	2,200	2,000	2,000	2,000	8,200		
Toshiba	N	800	600	500	350	2,250		
VLSI Technology	Ĉ	N/A	s	20	40	60		
WaferScale	N	N/A	N/A	s	10	10		
Mararocare	••							
	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%)	108	(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				
		1st	2nd	3rd	4th	••		
		Otr.	Otr.	Otr.	Otr.	Year		
Market Share								
U.S.		30.0%	31.34	29.24	26.19	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%	100.00	100.0%	100.0%	100.0%		

S = Sampling

N/A * Not Available

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

Table 4 (Continued)

64K MOS EPROM Shipment Data, 1980-1987

				1986		
	HOS	lst	2nd	3rà	4th	
Company	Process	Otr.	Otr.	Otr.	Otr.	<u>Year</u>
AMD	R	850	800	960	1.385	3.935
Fujitsu	N	1,500	1,500	2,000	4,000	9,000
10,1000	c	1,000	1,000	2,000	4.000	8,000
General Instruments	С	s	0	31	170	201
	OTP	N/A	N/A	8	10	10
Gold Star	c	s	S	0	5	5
Hitachi	N	5,400	5,000	4,500	4,000	18,900
	¢	700	700	700	700	2,800
Byundai	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	Q	25	50	75
SEEQ	N	525	6 15	315	150	1,605
Seiko-Epson	C	0	75	100	150	325
5 GS	N	552	608	2,500	2,500	6,160
Sharp	C	C	5	10	15	30
	OTP	S	ŝ	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	¢	0	10	70	10	30
Others	c	0	0	5	5	10
	N	20,691	19,438	20,369	22,042	82,540
	Č	3,055	3,580	4,221	6,230	17,086
Total		23,746	23,018	24,590	28,272	99,626
Percentage Change from				79	150	
Previous Quarter		(5%)	(36)		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	\$3.8 6
Overall		\$2.32	82.57	\$2.81	\$3.05	\$2.71
Revenue (\$M)		55.2	59.1	69.2	86.2	269.7
				1986		
		lst	2nd	3rd	4th	
		Otr.	Otr.	Otr.	Otr.	Year
Market Share		20.00	22.14	77 40	27.0%	29.2%
v.s.		29.9% 67.8	33.1 % 64.3	27.4% 62.4	27.0% 64.1	64.6
Japan			2.6	-	8.8	6.2
Europe ROW		2.3 0	0	10.2	0	0
Total		100.0%	100.0%	100.0%	100.04	100.0%
C = Espeling						

S = Sampling N/A = Not Available

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

Table 4 (Continued)

64K MOS EPROM Shipment Data, 1980–1987

				1987		
	MOS	lst	2ng	5rd	4th	
Company	Process	Otr.	Otr.	Otr.	Otr.	Year
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
	С	1,800	2,000	2,200	2,200	8,200
Gold Star	С	5	5	5	5	20
Hitachi	N	2,500	1,500	1,000	0	5,000
	С	700	700	400	٥	1,800
	COTP	0	50	100	0	150
Hyundai	C	5	5	10	20	40
Intel	N	1,400	1,400	1,100	1,700	5,600
	С	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
Mítsubishi	N	1,450	1,150	1,250	1,600	5,450
	OLD	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	Ş	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	Ç	50	50	100	100	300
SEEQ	N	200	200	200	200	800
Seiko-Epson	¢	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	460
	OTP	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	46,512
	¢	5,416	6,407	7,247	8,098	<u>27,168</u>
Total		18,178	18,722	18,866	19,914	75,680

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

			1987		
	lst	2nd	3rd	4th	
	Otr.	Otr.	Otr.	Otr.	Year
Percentage Change from					5
Previous Quarter	(36%)	(38)	14	64	
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		
	lst	2nd	3rd	4th	
	Otr.	Otr.	Otr.	Otr.	<u>Year</u>
Market Share					
v.s.	32.8%	37.9€	36.3%	45.9%	38.4%
Japan	60.8	49.7	47.2	36.9	48.4
Burope	6.4	12.0	15.8	17.0	12.9
ROW		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

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

		1982							
	MOS	lst	2no	3rd	4th				
Company	<u>Process</u>	Otr.	Otr.	Otr.	Otr.	Year			
AMD	N	N/A	N/A	N/A	s	0			
Pujitsu	N	N/A	N/A	N/A	ន	0			
	C	N/A	N/A	n/a	N/A	0			
Hitachi	N	N/A	N/A	N/A	8	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	и	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	<u>N/A</u>	<u>N/A</u>	<u>N/A</u>	N/A	<u>N/A</u>			
	N	3	15	55	155	228			
	c	0	0	0	0	0			
Total		3	15	55	155	228			
Percentage Change from Previous Quarter		o	400%	267%	182%				
Cumulative Total		3	18	73	228				
Average Selling Price		\$75.0 0	\$60.00	\$ 50. 0 0	\$40.00	\$44.19			
Revenue (\$M)		0.2	0.9	2.8	6.2	10.1			
				1982					
		lst	2nd	3rd	4th				
		Otr.	Otr.	Otr.	Otr.	<u>Year</u>			
Market Share									
υ.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%	100.00	100.00			

S = Sampling N/A = Not Available

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

		1983												
	MOS	lst	2nd	3rd	4th									
Company	Process	Otr.	Otr.	Otr.	Otr.	Year								
AMD	N	50	175	300	500	1,025								
Fujitsu	N	10	50	150	350	560								
	С	S	10	25	35	70								
Hitachi	N	10	50	150	350	560								
Intel	N	450	800	1,200	1,500	3,950								
Mitsubishi	19	s	10	10	10	30								
	c	N/A	A\N	N/A	N/A	0								
NEC	n	S	10	20	100	130								
ŝeeo	N	N/A	s	50	100	150								
Texas Instruments	N	0	0	0	0	٥								
	c	N/A	N/A	n/A	N/A	0								
Toshiba	N	<u> </u>	10	2.0	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%	1148	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								
				1983										
		lst	2nd	319	4th									
		Qtr.	Otr.	Otr.	Otr.	<u>Year</u>								
Market Share														
U.S.		96.2%	87.4%	80.5%	70.18	78.2%								
Japan		3.8	12.6	19.5	29.9	21.8								
Europe		0	0	0	0	0								
Total		100.0%	100.00	100.0%	100.0%	100.0%								

S = Sampling N/A = Not Available

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

		1984											
	MOS	lst	2nd	3rd	4th								
Company	Process	<u>Otr.</u>	Otr.	Otr.	Otr.	<u>Year</u>							
AMD	N	500	800	850	900	3,050							
Fujitsu	N	550	750	800	700	2,800							
•	¢	50	75	100	100	325							
Hítachi	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	И	20	160	600	1,000	1,780							
SEEQ	N	150	40 0	525	575	1,650							
Texas Instruments	N	10	25	25	25	85							
	С	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							
	С	50	<u>75</u>	100	100	<u> 325</u>							
Total		3,590	6,310	8,600	11,400	29,900							
Percentage Change from Previous Quarter		20%	76%	361	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	\$16.00	\$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							
				1984									
		lst	2nd	3rd	4th								
		Otr.	Otr.	Otr.	Otr.	Year							
Market Share													
U.S.		60.20	44.8%	36.0%	32.5%	39.48							
Japan		39.8	55.2	64.0	67.5	60.6							
Europe		0	0	0	0	0							
Total		100.00	100.0%	100.0%	100.0%	100.00							

\$ = Sampling
N/A = Not Available

Table 5 (Continued)

128K MOS EPROM Shipment Data, 1982–1987

		_		1985		
	MOS	lst	2nd	3rd	4th	
Company	Process	Otr.	Otr.	Otr.	Otr.	Year
AMD	n	1,150	950	850	900	3,850
Fujitsu	N	1,000	1,500	1,750	2,000	6,250
•	С	100	100	100	100	400
Hitachi	N	3,000	3,200	3,500	3,100	12,800
Intel	N	2,000	1,600	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
	и	11,875	12,975	14,300	16,125	55,275
	С	105	110	110	225	<u> 550</u>
Total		11,980	13,085	14,410	16,350	55,825
Percentage Change from						
Previous Quarter		50	91	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	\$3.1 1	\$2.62	\$3.9 5
Revenue (\$M)		78.6	54.2	44.9	42.8	220.6
				1985		
		lst	2nd)rd	4th	
		Otr.	Otr.	Qtr.	Otr.	<u>Year</u>
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
Total		100.0%	100.0%	100.0%	100.0%	100.0%

5 = Sampling
N/A = Not Available

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

				1986		
	MOS	lst	2nd	350	4th	
Company	Process	Otr.	Otr.	Otr.	Otr.	Year
AMD	N	1,300	1,100	1,050	1,715	5,165
Pujit s u	Ñ	800	800	800	800	3,200
	C	100	100	100	100	400
General Instrument	С	N/A	8	20	150	170
	OTP	N/A	N/A	s	10	10
Hitachi	N	3,200	3,000	2,500	2,500	11,200
Intel	14	2,200	2,600	2,800	2, 9 00	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	O
NEC	N	3,110	3,000	1,520	1,000	8,630
SEEQ	Ŋ	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
	С	100	175	225	400	900
Toshiba	И	700	700	700	600	2,700
	OTP	50	200	400	600	1,250
VLSI Technology	С	5	10	10	10	35
WaferScale	¢	S	0	5	5	10
Others	С	<u> </u>	<u></u> <u>s</u>	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	(104)	0	
Cumulative Total		107,623	122,713	136,253	149,638	
ASPs: NMOS		\$2.55	\$2.65	\$2.75	\$2.75	\$ 2,67
ASPE: AMOS CMOS		\$3.70	\$3.90	\$4.00	\$4.00	\$ 3.94
Overall		\$2.57	\$2.68	\$2.79	\$2.82	\$ 2.71
Overall		3 2.57	34.05	\$2. 19	32.62	\$ 2.71
Revenue (\$M)		38.9	40.4	37.6	38.4	155.5
				1986		
		lst	2nd	3rd	4th	
		Otr.	Otr.	Otr.	Otr.	Year
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

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

				_ 1987		
	MOS	lst	2nd	3rd	4th	
Company	Process	Otr.	Otr.	Otr.	Otr.	<u>Year</u>
AMD	N	1,300	1,925	1,725	1,900	6,850
F ujit s u	И	1,000	1,200	1,100	1,100	4,400
	¢	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
	COTP	. 0	0	20	20	40
Microchip Tech., Inc.	С .	141	227	420	741	1,529
	COTP	20	45	80	228	373
Mitsubishi	и •	1,150	1,300	1,400	950	4,800
	¢	40	100	130	60	330
	N OTP C OTP	120	250	300	100	770
National Cont		0 22 2	0 191	0 223	0 390	0 1.026
National Semi. NEC	C N	900	590	430	330	2,250
Oki Electric	n N	100	150	100	100	450
ORI Electric	n otp	100	120	100	0	130
SEEO	N OIF	150	150	100	100	500
Seiko-Epson	ัด	230	10	15	25	50
SGS-Thomson	N N	180	525	1,160	1,700	3,565
Texas Instruments	N	0	25	25	70	120
26740 211001000	Ċ	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	Ċ	s	0	5	5	10
	N	11,300	12,475	11,575	10,965	46,315
	Ċ	1,826	2,423	3,138	3,854	11,243
Total		13,128	14,898	14,713	14,819	57,558
Percentage Change from						
Previous Quarter		(34)	138	(11)	14	
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
				1007		
		lst	2nd	1987 3rd	4th	
		Otr.	Otr.	Otr.	Otr.	Year
		<u> </u>	<u>ver.</u>	<u>ver-</u>	<u>V61.1</u>	1401
Market Share						
v.s.		42.98	43.49	36.6%	49.61	43.21
Japan		55.7	53.0	55.6	38.9	50.6
Europe		1.4	3.5	7.9	11.5	6.2
Total		100.04	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

Table 6
256K MOS EPROM Shipment Data, 1983-1987

				1983		
	MOS	lst	2nd	3rd	4th	
Company	Process	Otr.	Otr.	Otr.	Otr.	Year
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
Fujitso	N	N/A	N/A	N/A	N/A	Đ
	¢	8	\$	5	20	25
General Instrument	N	N/A	N/A	N/A	N/A	0
	С	N/A	N/A	N/A	N/A	0
Hitachi	N	N/A	N/A	N/A	n/a	0
	С	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.	¢	N/A	N/A	N/A	N/A	0
NEC	N	N/A	N/A	N/A	5	0
	¢	N/A	N/A	n/a	N/A	0
SEEQ	С	N/A	N/A	N/A	N/A	0
Seiko-Epson	Ċ	N/A	N/A	N/A	N/A	0
SG5-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
	С	A\M	N/A	N/A	N/A	0
VLSI Technology	C	N/A	N/A	N/A	N/A	0
WaferScale	С	N/A	<u> N/A</u>	N/A	<u>n/a</u>	0
	n	5	10	45	115	175
	С	0	0	5		_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		Û	0	\$145	\$115	\$121
Overall		\$150	\$125	\$105	\$98	\$102
Revenue (\$M)		0.8	1.3	5.2	13.2	20.5
				1983		
		lst	2nd	3rd	4th	
		Otr.	Otr.	Otr.	Otr.	<u>Year</u>
Market Share						
U.S.		100.0%	100.0%	90.0%	85.2%	87.5%
Japan		0	O	10.0	14.8	12.5
Europe		0	0	0	0	0
Total		100.04	100.0%	100.00	100.0%	100.0%

S = Sampling N/A = Not Available

Table 6 (Continued)
256K MOS EPROM Shipment Data, 1983–1987

				1984		
	MOS	lst	2nd	3rd	4th	
Сомралу	Process	Otr.	Ott.	Otr.	Otr.	<u>Year</u>
AMD	N	100	130	100	250	580
Atmel	N	A\A	N/A	N/A	N/A	0
	С	N/A	N/A	N/A	A/M	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
	С	N/A	N/A	N/A	N/A	0
Hitachi	N	N/A	N/A	S	Ş	Ð
	c	N/A	N/A	5	S	0
Intel	N	150	250	375	475	1,250
	С	N/A	N/A	N/A	N/A	0
Mitsubishi	N	s	S	ន	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
SEEO	c	N/A	s	Ś	5	5
Seiko-Epson	Ċ	N/A	N/A	R/A	N/A	Ö
sgs	N	N/A	N/A	N/A	N/A	Ö
Texas Instruments	Ċ	N/A	N/A	N/A	N/A	ō
Toshiba	N	10	30	50	100	190
	č	N/A	N/A	s	s	0
VLSI Technology	Č	N/A	N/A	N/A	N/A	Õ
WaferScale	č	N/A			_	
	N	260	410	525	845	2,040
	Č	30	_40	_50	80	
Total		290	450	575	925	2,240
Percentage Change from						
Previous Quarter		1154	55%	28%	614	
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	\$64.0 0
Overall		\$77.59	\$48.11	\$37.17	\$29.47	\$41.42
Revenue (\$M)		22.5	21.7	21.4	27.3	92.8
				1984		
		lst	2nd	3rd	4th	
		Otr.	Otr.	Otr.	Otr.	<u>Year</u>
Market Share					<i>,</i> '	
v.s.		86.2%	84.4%	82.6%	76.9%	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

Table 6 (Continued)

256K MOS EPROM Shipment Data, 1983-1987

				1985		
	MOS	lst	2nd	3rd	4th	
Company	Process	Otr.	Otr.	Otr.	Otr.	<u>Year</u>
AMD	N	450	800	950	950	3,150
Atmel	n	N/A	N/A	N/A	5	0
	C	N/A	N/A	A/M	s	0
Pujit s u	N	25	200	400	650	1,275
	С	150	250	400	600	1,400
General Instrument	N	N/A	N/A	S	25	25
	c	N/A	N/A	8	10	10
Hitachi	N	50	200	500	800	1,550
	Ç	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	10	10
NEC	N	30	230	550	750	1,560
	¢	S	50	150	200	400
SEEQ	c	15	110	180	250	5 55
Seiko-Epson	c	N/A	N/A	N/A	S	0
SGS	N	N/A	N/A	S	10	10
Texas Instruments	¢	N/A	N/A	S	50	50
Toshiba	N	150	350	550	700	1,750
	С	150	200	300	425	1,075
VLSI Technology	С	N/A	s	25	50	7 5
WaferScale	c	N/A	A/N	<u> </u>		0
	N	1,710	3,605	5,420	7,185	17,920
	¢	315	635	<u>1,255</u>	<u>1,995</u>	4,200
Total		2,025	4,240	6,675	9,180	22,120
Percentage Change from						
Previous Quarter		350%	109%	574	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		
		lst	2no	319	4th	
		Otr.	Otr.	Otr.	Otr.	<u>Year</u>
Market Share					•	
v.s.		72.3%	63.9%	54.0%	45.2%	53.98
Japan		27.7	36.1	46.0	54.7	46.0
Europe			0	0	0.1	0
Total		100,0%	100.0%	100.0%	100.04	100.0%

S = Sampling

N/A = Not Available

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

Table 6 (Continued)
256K MOS EPROM Shipment Data, 1983–1987

orp orp 1, 3, orp 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,
C OTP 350 250 250 250 250 250 250 250 250 250 2
C 200 250 250 250 N 908 600 545 10 112 317 493 C 201P 35 85 10 N 950 C 250 250 C 250 C 250 N 201P 200 250 N
C 200 250 250 250 N 908 600 545 10 112 317 493 C 201P 35 85 10 N 950 C 250 250 C 250 C 250 N 950 C 255 N 950 S 255
C 200 250 250 250 N 908 600 545 C 112 317 493 C OTP 35 85 10 N 950 1,100 1,350 C OTP 250 250 250 N 900 1,637 2,096 1,776 C OTP 250 1,235 10 5 10 5 10 5 10 5 10 5 10 5 10 5 10
C OTP 3,00 250 250 0 000 000 000 000 000 000 000
C OTP 350 250 250 N 908 600 545 C OTP 35 85 10 N 950 1,100 1,350 C OTP 350 250 250 N OTP 10 N OTP 1,249 1,480 1,435 C C OTP 250 1,220 1,140 N N N N N N N N N N N N N N N N N N N
C OTP 350 250 250 N 908 600 545 C OTP 35 85 10 N 950 C OTP 350 1,100 1,350 C OTP 350 250 N OTP 1,249 1,480 1,435 C C OTP 250 N N OTP 1,230 1,220 1,140 N N OTP 300 800 800 800 800
C 200 250 250 250 N 908 600 545 C 112 317 493 C 270 C 270 N 950 1,100 1,350 1,000 C 250 N 970 N 950 1,200 4,200 4,200 N 950 1,637 2,096 1,776 C 250 N 970 1,235 3,000 600 800 800 800 800 800 800 800 800
C 200 250 250 N 908 600 545 C 112 317 493 C OTP 35 85 10 N 950 1,100 1,350 1, C OTP 350 500 650 C OTP 0 0 0 0 N OTP 200 250 280 N OTP 1,249 1,480 1,435 3, C OTP 25 100 250 N 1,230 1,250 990 C 1,620 1,220 1,140 N N 1,637 5 10 C 70 70 70 40 C 70 70 70 40 C 125 200 800 800
C 200 250 250 N 908 600 545 C 112 317 493 C OTP 35 85 10 N 950 1,100 1,350 1, C OTP 350 500 650 C OTP 0 0 0 0 N OTP 200 250 280 N OTP 1,249 1,480 1,435 3, C OTP 25 100 250 N 1,230 1,250 990 C 1,620 1,220 1,140 N N N N N N N S 0 C 70 70 70 40 C 125 200 225 C 125 200 225
C 200 250 250 250 0 250
C 200 250 250 250 250 250 250 250 250 250
C 200 250 250 250 250 250 250 250 250 250
C 200 250 250 N 908 600 545 C 112 317 493 C OTP 35 85 10 N 950 1,100 1,350 1, C OTP 0 0 0 0 N OTP 200 250 250 N OTP 1,537 2,096 1,776 C OTP 0 0 0 1,435 3, C OTP 250 1,250 990 N 1,230 1,250 990 N 1,230 1,250 990 N 1,230 1,250 1,140 N N/A S 0 5 70 70 40
C 200 250 250 N 908 600 545 C 112 317 493 C OTP 35 85 10 N 950 1,100 1,350 1, C OTP 0 0 0 0 N OTP 200 250 250 N OTP 200 250 280 N OTP 1,537 2,096 1,776 C OTP 0 0 0 19 N OTP 1,249 1,480 1,435 3, C OTP 25 100 250 N 1,620 1,250 990 C 1,620 1,250 1,140 N N N/A S 0 5
C 250 250 250 250 250 250 250 250 250 250
C 200 250 250 250 250 250 250 250 250 250
C 200 250 250 N 908 600 545 C 112 317 493 C OTP 35 85 10 N 950 1,100 1,350 1, C OTP 0 0 0 0 N 0TP 200 250 280 N OTP 1,637 2,096 1,776 C OTP 0 0 0 19 N OTP 1,249 1,480 1,435 3, C 0 0 1,230 1,250 990
C 200 250 250 N 908 600 545 C 112 317 493 C OTP 35 85 10 N 950 1,100 1,350 1, C OTP 0 0 0 0 N 0TP 200 250 250 N OTP 1,249 1,480 1,435 3,00 C 250 C OTP 0 0 0 0 0 0 C OTP 0 0 0 0 0 0 N OTP 1,249 1,480 1,435 3,400 C 250
C 200 250 250 N 908 600 545 C 112 317 493 C OTP 35 85 10 N 950 1,100 1,350 1, C OTP 0 0 0 0 N 3,300 4,000 4,200 4, C 150 175 450 N OTP 200 250 280 N OTP 1,249 1,480 1,435 3, C OTP 0 0 0 0
C 200 250 250 N 908 600 545 C 112 317 493 C OTP 35 85 10 N 950 1,100 1,350 1, C OTP 0 0 0 0 N 3,300 4,000 4,200 4, N OTP 200 250 280 N OTP 1,549 1,480 1,435 3,
C 200 250 250 N 908 600 545 C 112 317 493 C OTP 35 85 10 N 950 1,100 1,350 1, C OTP 0 0 0 0 N 3,300 4,000 4,200 4, N OTP 200 250 280 N 1,637 2,096 1,776 C 0 0 0 19
C 200 250 250 N 908 600 545 C 112 317 493 C OTP 35 85 10 N 950 1,100 1,350 1, C OTP 0 0 0 0 N 3,300 4,000 4,200 4, N OTP 200 250 280 N 1,637 2,096 1,776
C 200 250 250 N 908 600 545 C 112 317 493 C OTP 35 85 10 N 950 1,100 1,350 1, C OTP 0 0 0 0 N 3,300 4,000 4,200 4, N OTP 200 250 280
C 200 250 250 N 908 600 545 C 112 317 493 C OTP 35 85 10 N 950 1,100 1,350 1, C OTP 0 0 0 0 N 3,300 4,000 4,200 4, C 150 175 450
C 200 250 250 N 908 600 545 C 112 317 493 C OTP 35 85 10 N 950 1,100 1,350 1, C OTP 0 0 0 0 N 3,300 4,000 4,200 4,
C 200 250 250 N 908 600 545 C 112 317 493 C OTP 35 85 10 N 950 1,100 1,350 1, C OTP 0 0 0
C 200 250 250 N 908 600 545 C 112 317 493 C OTP 35 85 10 N 950 1,100 1,350 1,
C 200 250 250 C 200 250 250 N 908 600 545 C 112 317 493 C OTP 35 85 10 N 950 1,100 1,350
C 200 250 250 N 908 600 545 C 112 317 493 C 0TP 35 85 10
C 200 250 250 N 908 600 545 C 112 317 493
C 200 250 250 N 908 600 545
200 250 250
200
5 00
0 0 0 0
0 0 0
N 700 1,000 1,050 1,000
Process Otr. Otr. Otr.
1st 2nd 3rd

Table 6 (Continued)
256K MOS EPROM Shipment Data, 1983-1987

		_	1986		
	lst	2nd	3rd	4th	
·	Otr.	Otr.	Otr.	Otr.	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		
	lst	2nd	3rd	4th	
	Otr.	Otr.	Otr.	Otr.	<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	0.0	<u> </u>	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.

Table 6 (Continued)

256K MOS EPROM Shipment Data, 1983–1987

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

Table 6 (Continued)
256K MOS EPROM Shipment Data, 1983-1987

		_	1987		
	lst	2nd	3rd	4th	
	Otr.	Otr.	Otr.	Otr.	<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		
	lst	2nd	3rd	4th	
	Otr.	Otr.	Otr.	Otr.	<u>Year</u>
Market Share					
U.S.	41.8%	44.6%	41.3%	49.5%	44.3%
Jap an	54.3	50.8	53.7	43.4	50.5
Europe	<u>3.9</u>	4.6	5.0	<u>7.1</u>	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

Table 7 512K MOS EPROM Shipment Data, 1984-1987

				1984		
	MOS	lst	2nd	3rd	4th	
Company	Process	Otr.	Otr.	Otr.	Qtr.	Year
AMD	N	s	2	2	4	
Pujitsu	N	N/A	N/A	N/A	N/A	o
General Instrument	Ċ	N/A	N/A	N/A	N/A	Ō
Hitachi	N	N/A	N/A	N/A	N/A	Ō
	Ċ	N/A	N/A	N/A	N/A	0
Intel	N	N/A	8	2	6	8
Mitsubishi	N	N/A	N/A	N/A	N/A	٥
Toshiba	N	N/A	N/A	N/A	N/A	0
	c	N/A	N/A	N/A	R/A	0
VLSI Technology	Č	N/A	N/A	N/A	N/A	ō
WaferScale	Č	N/A	N/A	N/A	N/A	0
	N	0	2	4	10	16
	С	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	
Overall		\$250.00	\$150.00	\$120.00	\$95.00	\$108.13
Revenue (\$M)		0	0.3	0.5	1.0	1.7
				1984		
		lst	2nd	3rd	4th	
		Otr.	Qtr.	Otr.	Otr.	<u>Year</u>
Market Share						
v.s.		0	100.01	100.00	100.0%	100.0
Japan		0	0	0	0	0
Europe		0	0	0	0	0
Total		0	100.0%	100.0%	100.0%	100.00
S = Sampling N/A = Not Available						

Table 7 (Continued)
512K MOS EPROM Shipment Data, 1984-1987

				1985		
	MOS	let	2nd	314	4th	
Company	Process	Otr.	Otr.	Otr.	Otr.	<u>Year</u>
AMD	N	12	30	35	75	152
Pujitsu	N	N/A	N/A	s	10	10
General Instrument	c	N/A	N/A	N/A	N/A	G
Hitacni	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	Đ
VLSI Technology	C	N/A	N/A	N/A	N/A	0
WaferScale	С	<u>N/A</u>	<u>n/a</u>	N/A	<u>N/A</u>	0
	n	27	80	100	225	432
	c	0	0	0	<u> 10</u>	_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		
		lst	2nd	3rd	4th	
		Otr.	Otr.	Otr.	Otr.	<u>Year</u>
Market Share						
v.s.		100.00	100.0%	100.0%	89.4%	94.34
Japan		0	0	0	10.6	5.7
Europe		0	0	0	0	0
Total		100.0%	100.00	100.0%	100.0%	100.04

S = Sampling N/A = Not Available

Table 7 (Continued)
512K MOS EPROM Shipment Data, 1984–1987

				1986		
	MOS	lst	2nd	βrά	4th	
Company	Process	Otr.	Otr.	Otr.	Otr.	<u>Year</u>
AMD	N	175	280	540	400	1,395
Pujitsu	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.	¢	N/A	S	0	Ō	0
Oki Electric	N	N/A	N/A	S	s	0
Texas Instruments	c	N/A	N/A	S	50	50
Toshipa	N	50	150	300	400	900
	OTP	N/A	N/A	S	30	30
VLSI Technology	C		0	3	5	8
WaferScale	c	N/A	N/A	N/A	N/A	.0
Others	С	<u>_s</u>	5	5	5	15
	N	475	830	1,688	2,395	5,388
	С	<u>25</u>	<u>40</u>	<u>58</u>	<u> 190</u>	313
Total		500	870	1,746	2,585	5,701
Percentage Change from						
Previous Quarter		1134	74%	101%	484	
Cumulative Total		958	1,828	3,574	6,159	
ASPs: NMOS		\$14.00	\$12.00	\$12.00	\$11.00	\$ 11.73
ASPS: NMOS CMOS		\$16.50	\$15.50	\$15.00	\$13.00	\$13.97
Overall		\$14.13	\$12.16	\$12.10	\$11.15	\$11.85
Ovetati		424.13	412120	412.10	411113	011.03
Revenue (\$M)		7.1	10.6	21.1	28.8	67.6
				1986		
		lst	2nd	319	4th	
•		Otr.	Otr.	Otr.	Otr.	Year
Market Share						
U.S.		85.0%	79.9%	74.6%	56.70	68.2%
Japan		15.0	20.1	25.4	43.3	31.8
Entobe		0		0	0	0
Total		100.00	100.0%	100.0%	100.0%	100.0%

S = Sampling
N/A = Not Available

Table 7 (Continued)
512K MOS EPROM Shipment Data, 1984-1987

				1987		
	MOS	lst	2nd	3rd	4th	
Company	Process	Otr.	Otr.	Otr.	Otr.	Year
AMD	N	740	785	525	603	2,655
	C	S	5	25	285	31,5
Fujitsu	Ç	500	1,500	1,800	2,100	5,900
Bitachi	N	750	800	850	950	3,350
	С	Ş	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.	С	0	Û	0	0	0
NEC	c	N/A	8	0	1,050	1,050
Oki Electric	N	0	180	200	400	780
	n otp	. 0	170	200	650	1,020
SGS-Thomson	и	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	С	0	0		0	0
	N	3,790	4,616	5,725	8,075	22,206
	C	<u>715</u>	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%	228	534	
Cumulative Total		10,664	17,100	24,975	37,033	
ASPs: NMOS		\$10.00	\$ 9.00	\$7.78	\$6.00	\$ 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
			_	1987		
		lst	2nd	3ra	4th	
		Otr.	Otr.	Otr.	Otr.	<u>Year</u>
Market Share						
υ . 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%	100.00	100.0%	100.0%	100.0%

S = Sampling
N/A = Not Available

Source: Dataquest Nav 1989

Table 8

1-Mbit MOS EPROM Shipment Data, 1986-1987

					1986		
	MOS	Technology	1st	2nd	310	4th	
Company	Process	Peatures	<u>Qtr.</u>	<u>Qtr.</u>	Otr.	Otr.	Year
AMD	¢	*16	1	1	4	6	12
Atmel	С	N/A	0	0	0	Ô	0
Fujitsu	C	x8, x16	N/A		S		1
General Instrument	С	x16	N/A	N/A	N/A	N/A	0
Hitachi	C	x8, x16	S			75	115
Intel	N	x8, x16	8	5	25	30	60
Motorola	С	N/A	S	S	s	0	0
National Semi.	С	x8, x16	N/A		N/A		0
NEC	С	x1 6	N/A		0	1	1
Oki Electric	c	x16	A/M	N/A	N/A	S	0
Texas Instruments	¢	N/A	N/A	R/A			0
Toshiba	C	x8	N/A	s	5		
Other	С	N/A	<u>N/A</u>	<u>n/a</u>	<u> </u>	0	0
	N		0	_	25		60
	c		_1	<u> 11</u>	_39	_98	149
Total			1	16	64	128	209
Cumulative Total ASPs: NMOS CMOS Overall			\$110.00 \$150.00 \$150.00	\$80.00 \$70.00	\$66.00	\$60.00	\$62.62
Revenue (\$M)			0.1	1.2	3.8	7.1	12.2
					1986		
			lst	2nd	310	4 th	
			Qtr.	Otr.	Otr.	Otr.	<u>Year</u>
Market Share							
v.s.			100.0%		45.34	28.14	34.3%
Japan			0	62.5	54.7	71.9	65.7
Europe			0	0		0	0
			100.0%	100.0%	100.0%	100.0%	100.0%
Total							

Table 8 (Continued)

1-Mbit MOS EPROM Shipment Data, 1986-1987

					1987		
	MOS	Technology	lst	2nd	310	4th	
Company	Process	Features	Otr.	Otr.	Otr.	Ott.	Year
AMD	С	x16	5	5	5	15	30
Pujitsu	¢	x8, x16	N/A	s	5	10	15
Hitachi	C	x8, x16	100	70	150	250	570
Intel Microchip Tech.,	N	x8, x16	50	30	80	150	310
Inc.	С		N/A	N/A	N/A	N/A	0
Mitsubishi	c	x8, x16	0	5	5	80	90
National Semi.	Ċ	x8, x16	0	0	0	0	0
NEC	c	×8	N/A	0	50	_ 300	350
	Ċ	x16	N/A	Ů.	50	100	150
Oki Electric	ć	x8, x16	N/A	N/A	N/A	5	0
SGS-homson	Ċ	,	N/A	N/A	N/A	N/A	0
Texas Instruments	č		0	0	0	0	o
Toshba	Ċ	x8, x16	_20	40	40	_50	<u> 150</u>
	N		50	30	80	150	310
	С		<u>125</u>	<u>120</u>	<u>305</u>	805	1,355
Total			175	150	385	955	1,655
Percentage Change	£						
Previous Quarter	1104		371	(14%)	1574	1484	
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		
			lst	2nd	3rd	4th	. –
			Otr.	Otr.	<u>Otr.</u>	Otr.	Year
Market Share							
U.S.			31.40	23.34	22.16	17.3%	20.4%
Japan			68.6	76.7	77.9	82.7	79.6
Europe			°	0	<u>o</u>	0	°
Total			100.0%	100.04	100.01	100.0%	100.01
S = Sampling							
N/A = Not Availabl	.e						

Source: Dataquest May 1989

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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

_				1988		
·	MOS	lst	2nd	3rd	4th	
Company	<u>Process</u>	Otr.	Otr.	Otr.	Otr.	<u>Year</u>
AMD	И	275	345	440	480	1,540
Cypress	С	300	375	275	250	1,200
Intel	N	200	200	175	175	750
National Semi.	С	170	165	160	155	650
NEC	N	5	10	0	5	20
SGS-Thomson	. И	790	1,040	710	500	3,040
	С	30	35	30	30	125
Texas Instruments	И	85	70	30	25	210
	C	55	50	75	80	260
WaferScale	С	<u> 125</u>	175	<u>255</u>	<u> 280</u>	<u>835</u>
	NMOS	1,355	1,665	1,355	1,185	5,560
	CMOS	<u>680</u>	800	<u>795</u>	<u> 795</u>	3.070
Total		2,035	2,465	2,150	1,980	8,630
Percentage Change fr	OM	1-				
Previous Quarter	V	(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
	٠		Ma	rket Share		
•		lst	2nd	3rd	4th	
		Otr.	Otr.	Otr.	Otr.	<u>Year</u>
U.S.		59.5%	56.0%	65.6%	73.0%	63.1%
Japan		0.2	0.4	0	0.3	0.2
Europe		40.3	43.6	34.4	26.8	36.7
Total		100.0%	100.0%	100.0%	100.0%	100.0%

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

Source: Dataquest

MOS EPROM--Data Update

Table 2

32K MOS EPROM Shipment Data

				1988		
	MOS	1st	2nd	3rd	4th	
Company	Process	Otr.	Otr.	Otr.	Otr.	Year
» AMD	N	460	540	350	230	1,580
Fujitsu	n	0	0	0	0	0
	С	0	0	0	0	0
Hitachi	n	0	0	0	0	0
ICT	С	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	С	600	525	400	375	1,900
NEC	N	10	20	0	0	30
Ricoh	C	0	0	0	0	0
SGS-Thomson	И	890	630	510	470	2,500
	C	25	15	30	30	100
Texas Instruments	И	<u>850</u>	<u>. 850</u>	<u>750</u>	<u>600</u>	3,050
	N	3,460	3,290	2,810	2,300	11,860
	С	<u>631</u>	552	442	<u>421</u>	2,046
Total		4,091	3,842	3,252	2,721	13,906
Percentage Change f	rom					
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
			Ma	rket Share	·	•
		1st	2nd	3rđ	4th	
*		Otr.	Otr.	Otr.	Otr.	<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		22.4	<u>16.8</u>	<u> 16.6</u>	18.4	<u> 18.7</u>
Total	h uz	100.0%	100.0%	100.0%	100.0%	100.0%

Source: Dataquest

May 1989

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MOS EPROM—Data Update

Table 3
64K MOS EPROM Shipment Data

	NOS	lst	2nd	3rd	4th	
Company	Process	Otr.	Otr.	Otr.	Otr.	Year
AMD	z	1,525	1,340	1,300	1,100	5,265
	a	0	0	0	UI	(J)
Atmel	a	0	0	0	140	140
Cypress	O	100	80	80	50	310
Fujitsu	¥	30	27	25	20	102
1	n	100	100	70	80	350
Gold Star	a	25	80	100	100	305
	C 35ns	w	2	15	28	45
Hitachi	z	0	0	0	275	275
	ი	0	0	0	0	0
	COTP	0	0	0	0	0
Hyundai	n	40	U.	115	150	360
ICT	ი	11	16	19	23	69
Intel	¥	2,100	2,400	2,000	2,300	8,800
	ი	250	250	250	580	1,330
	C OTP	150	400	400	600	1,550
Microchip Tech.	വ	509	375	554	400	1,838
	C OTP	100	96	150	150	496
Mitsubishi	×	1,200	1,000	1,000	800	4,000
	N OTP	300	300	200	160	960
Motorola	×	0	•	0	0	0
	N OTP	0	•	0	0	0
National Semi.	G	2,850	2,600	2,300	2,200	9,950
NEC	¥	0	0	0	0	0
	G	200	100	150	40	490
	C OTP	50	50	50	40	190
Oki	z	100	125	115	120	460
	N OTP	130	130	130	100	490
Ricoh	a	150	100	50	0	300
SEEQ	×	150	150	125	100	525
Seiko-Epson	റ	110	125	100	100	435
SGS-Thomson	×	2,045	2,365	2,940	2,600	9,950
	G	330	105	200	250	885 5
	COTP	100	100	150	400	750
Sharp	G	45	35	60	60	200
Signetics	O	1,200	1,700	1,900	1,200	6,000

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MOS EPROM-Data Update

Table 3 (Continued)
64K MOS EPROM Shipment Data

				1988		
	MOS	lst	2nd	3rd	4th	
Company	Process	Otr.	Otr.	Otr.	Otr.	<u>Year</u>
Texas Instruments	N	1,300	1,300	1,100	945	4,645
	С	25	50	100	100	275
	C OTP	30	100	110	120	360
Toshiba	N	300	280	260	250	1,090
	N OTP	500	' 4 50	400	350	1,700
WaferScale	С	<u>75</u>	80	100	110	<u>365</u>
	И	9,680	9,867	9,595	9,120	38,262
	С	6.450	6,599	7,023	<u>6,926</u>	<u> 26,998</u>
Total		16,130	16,466	16,618	16,046	65,260
Percentage Change f Previous Quarter	rom	(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
			м	arket Share	<u> </u>	
		lst	2nd	3rd	4th	_
		Otr.	Otr.	Otr.	Otr.	<u>Year</u>
v.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		0.4	0.8	1.4	1.7	1.1
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

Table 4
128K MOS EPROM Shipment Data

		1988									
	MOS	lst	2nd	3rd	4th						
Company	Process	Otr.	Otr.	Otr.	Otr.	<u>Year</u>					
AMD	И	1,800	2,500	1,700	1,500	7,500					
	С	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	И	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 OIP	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					
	С	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	С	20	20	25	30	95					
	N	10,480	12,190	10,955	10,495	44,120					
	С	4,085	<u>5,236</u>	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%)						

Table 4 (Continued)

128K MOS EPROM Shipment Data

	MOS	1st	2nd	3rd	4th						
Company	Process	Otr.	Otr.	Otr.	Otr.	<u>Year</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					
			м	arket Shar	.						
		lst	2nd	3rd	4th						
		Otr.	Otr.	Otr.	Otr.	Year					
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>	20.4	23.0	<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

Table 5
256K MOS EPROM Shipment Data

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

Table 5 (Continued) 256K MOS EPROM Shipment Data

				1988		
	MOS	1st	2nd	3rd	4th	
Company	Process	Otr.	Otr.	Otr.	Otr.	<u>Year</u>
Toshiba	N	900	750	660	500	2,810
	С	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	С	<u> 100</u>	<u> </u>	<u> 180</u>	200	605
	N	14,845	15,595	14,060	13,510	58,010
	С	<u>15.315</u>	<u>17.181</u>	<u>19,140</u>	21,146	72,782
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
			1	Market Sha	re	
		lst	2nđ	3rd	4th	
		Otr.	Otr.	Otr.	Otr.	<u>Year</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		10.2	9.7	<u> 13.3</u>	<u> 15.3</u>	12.2
Total		100.0%	100.0%	100.0%	100.0%	100.0%

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

Source: Dataquest

Table 6
512K MOS EPROM Shipment Data

		1988									
	MOS	1st	2nd	3rd	4th						
Company	Process	Otr.	Otr.	Otr.	Otr.	<u>Year</u>					
AMD	N	550	1,200	1,340	1,400	4,490					
	С	495	485	560	625	2,165					
Atmel	С	32	36	28	29	125					
Catalyst	N OTP	0	0	20	30	50					
Fujitsu	С	1,700	1,800	1,600	1,800	6,900					
Hitachi	n	1,700	1,500	2,000	1,800	7,000					
	С	0	0	0	0	0					
Intel	N	2,700	2,500	1,900	1,900	9,000					
Microchip Tech.	С	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					
	С	N/A	N/A	50	500	550					
National Semi.	С	0	0	0	0	0					
NEC .	С	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					
	С	0	30	120	300	450					
	C OTP	0	0	40	60	100					
WaferScale	С	<u> </u>	50	55	70	<u>175</u>					
	N	9,905	10,025	9,535	9,730	39,195					
•	С	4,437	4,951	_5,173	6,734	<u>21,295</u>					
Total		14,342	14,976	14,708	16,464	60,490					
Percentage Change f	rom										
Previous Quarter		20%	4%	(2%)	12%						
Cumulative Total		51,155	66,131	80,839	97,303						

Table 6 (Continued)

512K MOS EPROM Shipment Data

1000

				1988		
	MOS	1st	2nd	3rđ	4th	
Company	Process	Otr.	Otr.	Otr.	Otr.	Year
ASPs:	NMOS	\$7.20	\$7.00	\$7.10	\$7.20	\$7.12
	CMOS	\$8.00	\$7.80	\$7.75	\$7.70	\$7.80
	Overal1	\$7.45	\$7.26	\$7.33	\$7.40	\$7.36
Japan 40 spot 11.	94 OEM 7.16					
Revenue (\$M)		106.8	108.8	107.8	121.9	445.3
			M	arket Shar	e	
		lst	2nd	3rd	4th	
		Otr.	Otr.	Otr.	Otr.	<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	<u>7.4</u>
Total		100.0%	100.0%	100.0%	100.0%	100.0%

N/A = Not Available

Source: Dataquest

Table 7 1-Mbit MOS EPROM Shipment Data

		•				1988		
		Max.		lst	2nđ	3rd	4th	
Company	Technology		<u>Features</u>	Otr.	Otr.	Otr.	Otr.	<u>Year</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		x 8	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		x 16	N/A	N/A	s	50	50
Sharp	CMOS		x8,x16	0	5	10	30	45
Toshiba	CMOS		x 8	150	175	200	350	875
	CMOS	150ns	x16	N/A	S	5	10	15
•	CMOS/OTP		x 8	N/A	S	0	5	5
	CMOS/OTP		x 16	20	20	50	<u> 100</u>	<u>190</u>
	N			180	190	250	650	1,270
	С			1,130	<u>1,395</u>	2.270	2.970	7,765
Total				1,310	1,585	2,520	3,620	9,035
Percentage	Change from							
Previous Q	uarter		•	37%	21%	59%	44%	
Cumulative 1	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 sp	ot 27.85 OE	M 12.73						
Revenue (\$M)		28.2	32.3	48.6	67.1	176.2	

Table 7 (Continued)

1-Mbit MOS EPROM Shipment Data

	Market Share									
	lst	2nd	3rd	4th						
	<u>Otr.</u>	Otr.	Otr.	Otr.	<u>Year</u>					
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

					1988		
Company	MOS Process	Technology <u>Features</u>	1st Otr.	2nd Otr.	3rd Otr.	4th Otr.	Year
NEC	CMOS	x8 150ns	N/A	N/A	<u>s</u>	Q	<u>o</u>
Total			0	0	0	0	0
Cumulative	Total		0	0	0	0	
ASPs:	NMOS CMOS Overall						0 0 0
Revenue (\$	EM)		Ö:	0	0	0	0
				Ma	rket Sha	are	
			1st Qtr.	2nd Otr.	3rd Otr.	4th Otr.	Year
U.S.			0	0	0	0	0
Japan			0	0	0	0	0
Europe			<u>o</u>	Ō	<u>Q</u>	Q	<u>o</u>
Total			0	0	0	0	0
W/1 - Was							

N/A = Not Available S = Sampled

Source: Dataquest

Table 9
4-Mbit MOS EPROM Shipment Data

					1988		
	MOS	Technology	1st	2nd	3rd	4th	
Company	Process	<u>Features</u>	Otr.	Otr.	Otr.	Otr.	<u>Year</u>
Fujitsu	CMOS	x 8	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	<u>n/a</u>	N/A	<u>N/A</u>	<u>N/A</u>	
Tota	1		40	50	60	80	. 230
Percentag	ge Change fr	com					
Previous	Quarter		-	25%	20%	33%	
Cumulativ	e 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
				Ma	rket Sha	ire	
			lst	2nd	3rd	4th	

	Market Share								
	1st Otr.	2nd Otr.	3rd Otr.	4th Otr.	Year				
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 AvailableS = Sampled

> Source: Dataquest May 1989

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.

Table 1

16K MOS EPROM Shipment Data

	•			_ 1988		
	MOS	lst	2nd	3rd	4th	
Company	Process	Otr.	Otr.	Otr.	Otr.	<u>Year</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.	С	170	165	160	155	650
NEC	N	5	10	0	5	20
SGS-Thomson	N	790	1,040	710	500	3,040
	С	30	35	30	30	125
Texas Instruments	N	85	70	30	25	210
	C	55	50	75	80	260
WaferScale	С	<u>125</u>	<u> 175</u>	<u>255</u>	280	<u>835</u>
	NMOS	1,355	1,665	1,355	1,185	5,560
	CMOS	<u>680</u>	<u>008</u>	<u> </u>	<u>795</u>	3,070
Total		2,035	2,465	2,150	1,980	8,630
Percentage Change fr	·Om					
Previous Quarter	. 0.11	(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
			_ Ma	rket Share		
		lst	2nd	3rd	4th	
		Otr.	Otr.	Otr.	Otr.	<u>Year</u>
U.S.		59.5%	56.0%	65.6%	73.0%	63.1%
Japan		0.2	0.4	0	0.3	0.2
Europe		40.3	43.6	34.4	26.8	<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

Table 2
32K MOS EPROM Shipment Data

		1988						
	MOS	lst	2nd	3rd	4th	lth .		
Company	<u>Process</u>	Otr.	Otr.	Otr.	Otr.	<u>Year</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	С	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	С	60 0	525	400	375	1,900		
NEC	N	10	20	0	0	30		
Ricoh	C	0	0	0	0	0		
SGS-Thomson	И	890	630	510	470	2,500		
	С	25	15	30	30	100		
Texas Instruments	N	<u>850</u>	<u>850</u>	<u>750</u>	<u>600</u>	<u>3,050</u>		
	И	3,460	3,290	2,810	2,300	11,860		
	С	<u>631</u>	<u> 552</u>	442	<u>421</u>	2.046		
Total		4,091	3,842	3,252	2,721	13,906		
Percentage Change f:	rom							
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>М</u> а	erket Share	•			
		1st	2nd	3rd	4th			
		Otr.	Otr.	Otr.	Otr.	<u>Year</u>		
v.s.		77.4%	82.7%	83.4%	81.6%	81.1%		
Japan		0.2	0.5	0	0	0.2		
Europe		22.4	16.8	<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

Table 3
64K MOS EPROM Shipment Data

				1988		
	MOS	1st	2nd	3rd	4th	
Company	Process	Otr.	Otr.	Otr.	Otr.	<u>Year</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	G	100	80	80.	50	310
Fujitsu	N	30	27	25	20	102
-	.©	100	100	70	80	350
Gold Star	С	25	80	100	100	305
	C 35ns	S	2	15	28	45
Hitachi	n	0	0	0	275	275
	С	0	0	0	0	0
	C OTP	0	0	0	0	0
Hyundai	E	40	55	115	150	360
ICT	Œ	11	16	19	23	69
Intel	N	2,100	2,400	2,000	2,300	8,800
	Ç	250	250	250	580	1,330
	C OTP	150	400	400	600	1,550
Microchip Tech.	С	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.	С	2,850	2,600	2,300	2,200	9,950
NEC	:N	0	0	0	0	0
	С	200	100	150	40	490
	C OTP	50	50	50	40	190
Oki	Ħ	100	125	115	120	460
	M OTP	130	130	130	100	490
Ricoh	C	<u>.</u> 150	100	50	0	300
SEEQ	Ŋ	150	150	125	100	525
Seiko-Epson	H C W	110	125	100	100	435
SGS-Thomson		2,045	2,365	2,940	2,600	9,950
	С	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

Table 3 (Continued) 64K MOS EPROM Shipment Data

				1988_		
	MOS	1st	2nd	3rd	4th	
Company .	Process	Otr.	Otr.	Otr.	Otr.	<u> Year</u>
Texas Instruments	И	1,300	1,300	1,100	945	4,645
	С	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>	80	100	110	<u>365</u>
	n	9,680	9,867	9,595	9,120	38,262
	C	6,450	<u>6,599</u>	7,023	6,926	<u>26,998</u>
Total		16,130	16,466	16,618	16,046	65,260
Percentage Change f	rom					
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
			м	<u>arket Shar</u>	0	
		1st	2nd	3rđ	4th	
		Otr.	Otr.	Otr.	Otr.	<u>Year</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		0.4	0.8	_1.4	<u> 1.7</u>	1.1
Total		100.0%	100.0%	100.0%	100.0%	100.0%

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

Source: Dataquest

Table 4
128K MOS EPROM Shipment Data

				1988		
	MOS	lst	2nđ	3rđ	4th	
Company	Process	Otr.	Otr.	Otr.	Otr.	<u>Year</u>
AMD	N	1,800	2,500	1,700	1,500	7,500
	С	0	0	0	5	5
Catalyst	N OTP	0	0	10	15	25
Fujitsu	Ŋ	900	1,100	875	700	3,575
	С	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
	С	300	200	300	300	1,100
	C OTP	0	50	50	50	150
Microchip Tech.	С	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
	С	150	250	150	100	650
•	N OTP	200	150	100 .	100	550
	C OTP	Ô	0	0	0	0
National	С	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	Ŋ	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
	С	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	С	20	20	25	30	95
	N	10,480	12,190	10,955	10,495	44,120
	С	4.085	<u>5,236</u>	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%)	

Table 4 (Continued)

128K MOS EPROM Shipment Data

				1988_		
	MOS	1st	2nd	3rd	4th	
Company	Process	Otr.	Otr.	Otr.	Otr.	<u>Year</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>_ M</u>	arket Share	e	
		lst	2nd	3rd	4th	
		Otr.	Otr.	Otr.	Otr.	Year
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>	14.3	20.4	<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

Table 5
256K MOS EPROM Shipment Data

				1988		
	MOS	lst	2nd	3rd	4th	
Company	<u>Process</u>	Otr.	Otr.	Otr.	Otr.	<u>Year</u>
AMD	N	1,585	1,535	1,400	1,260	5,780
	¢	250	300	720	820	2,090
Atmel	С	45	51	50	54	200
Catalyst	N OTP	0	0	25	50	75
Cypress	С	0	20	70	110	200
Fujitsu	И	1,000	1,100	1,000	1,000	4,100
	С	2,600	2,400	2,500	2,500	10,000
Hitachi	N	0	0	0	0	0
	С	0	0	0	0	0
	C OTP	0	0	0	0	0
Intel	N	4,500	4,900	4,600	4,800	18,800
	С	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
	С	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.	С	3,615	3,900	3,800	3,312	14,627
NEC	n	250	300	150	100	800
	С	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	С	25	30	35	40	130
SEEQ	С	120	80	70	70	340
Seiko Epson	С	30	55	70	70	225
SGS-Thomson	И	2,010	2,045	2,765	3,350	10,170
	С	0	20	315	520	855
	C OTP	0	0	50	400	450
Signetics	С	1,080	1,100	1,300	1,020	4,500
Sharp	Ċ	50	50	80	80	260
Texas Instruments	Ċ	2,200	2,200	2,300	2,100	8,800
	C OTP	50	100	200	300	650

Table 5 (Continued)
256K MOS EPROM Shipment Data

				1988		
	MOS	1st	2nd	3rđ	4th	
Company	Process	Otr.	Otr.	Otr.	Otr.	<u>Year</u>
Toshiba	n	900	750	660	500	2,810
	С	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	С	<u> </u>	<u>125</u>	<u> 180</u>	200	605
	N	14,845	15,595	14,060	13,510	58,010
	С	<u>15,315</u>	17,181	19,140	21,146	72,782
Total		30,160	32,776	33,200	34,656	130,792
Percentage Change	from					
Previous Quarter		2%	9%.	1%	4%	
Cumulative Total	٠	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
			1	Market Sha	re	
		1st	2nd	3rd	4th	_
		Otr.	Otr.	Otr.	Otr.	<u>Year</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		10.2	9.7	<u>13.3</u>	<u>15.3</u>	12,2
Total		100.0%	100.0%	100.0%	100.0%	100.0%

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

Source: Dataquest

Table 6
512K MOS EPROM Shipment Data

				1988		
	MOS	lst	2nd	3rd	4th	
Company	Process	Otr.	Otr.	Otr.	Otr.	<u>Year</u>
AMD	N	550	1,200	1,340	1,400	4,490
	С	495	485	560	625	2,165
Atmel	С	32	36	28	29	125
Catalyst	N OTP	0	0	20	30	50
Fujitsu	С	1,700	1,800	1,600	1,800	6,900
Hitachi	И	1,700	1,500	2,000	1,800	7,000
	С	0	0	0	0	0
Intel	И	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
	С	N/A	N/A	50	500	550
National Semi.	С	O-	0	0	0	0
NEC	С	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	С	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>\$</u>	50	<u>55</u>	70	<u> 175</u>
	N	9,905	10,025	9,535	9,730	39,195
	С	4,437	4,951	<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	

Table 6 (Continued)
512K MOS EPROM Shipment Data

				1988			
	MOS	1st	2nd	3rd	4th		
Company	Process	Otr.	Otr.	Otr.	Otr.	<u>Year</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 11.9	94 OEM 7.16						
Revenue (\$M)		106.8	108.8	107.8	121.9	445.3	
	•	Market Share					
		1st	2nd	3rd	4th		
		Otr.	Otr.	Otr.	Otr.	<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		<u>7.6</u>	10:3	7.4	
Total		100.0%	100.0%	100.0%	100.0%	100.0%	

N/A = Not Available

Source: Dataquest

Table 7

1-Mbit MOS EPROM Shipment Data

						1988		
		Max.		lst	2nd	3rd	4th	
Company	Technology	Acc.T.	<u>Features</u>	Otr.	Otr.	Otr.	Otr.	<u>Year</u>
AMD	CMOS	150ns	x 8	0	5	105	180	290
	CMOS	150ns	x 16	30	50	70	90	240
Atmel	CMOS	70ns	x 16	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		x 8	280	160	370	420	1,230
	CMOS		x1 6	100	80	240	150	570
Oki	CMOS		x8,x16	0	0	0	0	0
SGS-Thomson	CMOS		x 16	N/A	N/A	S	50	50
Sharp	CMOS		x8,x16	0	5	10	30	45
Toshiba	CMOS		x 8	150	175	200	350	875
	CMOS	150ns	x 16	N/A	s.	5	10	15
	CMOS/OTP		x 8	N/A	S	0	5	5
	CMOS/OTP		x1 6	20	20	50	100	<u>190</u>
	N			180	190	250	650	1,270
	С			1,130	1,395	<u>2.270</u>	2,970	7.765
Total				1,310	1,585	2,520	3,620	9,035
Percentage (Previous Q	-			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 sp	ot 27.85 OE	M 12.73			•			
Revenue (\$M)		28.2	32.3	48.6	67.1	176.2	

Table 7 (Continued)

1-Mbit MOS EPROM Shipment Data

		<u>M</u>	<u>larket Shar</u>	·e							
	lst	2nd	3rd	4th							
× i	Otr.	Otr.	Otr.	Otr.	<u>Year</u>						
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	<u> 1.4</u>	0.6						
Total	100.0%	100.0%	100.0%	100.0%	100.0%						

N/A = Not Available

S = Sampled

Source: Dataquest

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Table 8
2-Mbit MOS EPROM Shipment Data

•.					1988			
	MOS	Technology	1st	2nd	3rđ	4th		
<u>Company</u>	Process	<u>Features</u>	Otr.	Otr.	Otr.	Otr.	<u>Year</u>	
NEC	CMOS	x8 150ns	N/A	N/A	<u>s</u>	Q	٥	
Total	L		0	0	0	0	0	
Cumulative	• Total		0	0	0	0		
ASPs:	NMOS						0	
	CMOS						0	
	Overall						0	
Revenue (\$	SM)		0	0	0	0	0	
			Market Share					
			lst	2nd	3rd	4th		
			Otr.	Otr.	Otr.	Otr.	<u> Xear</u>	
U.S.			0	0	o	0	0	
Japan			0 .	0	0	0	0	
Europe			Q	<u>o</u>	Q	Q	<u>ِo</u>	
Tota]	L		0	0	0	0	0	
M/A - Not	Averilable							

N/A = Not Available

S = Sampled

Source: Dataquest

Table 9 4-Mbit MOS EPROM Shipment Data

					1988		
	MOS	Technology	lst	2nd	3rđ	4th	
Company	<u>Process</u>	<u>Features</u>	Otr.	Otr.	Otr.	Otr.	<u>Year</u>
Fujitsu	CMOS	x 8	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	<u>N/A</u>	N/A	<u> N/A</u>	<u> N/A</u>	0
Tota	1		40	50	60	80	230
	e Change fr	om				•••	
Previous	Quarter		-	25%	20%	33%	
Cumulative	e 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
				Ma	rket Sha	re	
			lst	2nd	3rd	4th	
			Otr.	Otr.	Otr.	Otr.	<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
Tota	ı		100.0%	100.0%	100.0%	100.0%	100.0%

N/A = Not Available S = Sampled

Source: Dataquest

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.

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

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

N/A = Not Available S = Sampling

Table 1 (Continued)

8K MOS EPROM Shipment Data, 1976-1985

	1st 2nd		3rd	4th				
Company	Otr.	Otr.	Otr.	Otr.	<u>Year</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>	200	<u>300</u>	700			
Total	335	520	850	1,210	2,915			
Percentage Change from	33 +							
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			
			1977					
	lst	2nd	3rd	4th				
	Otr.	Otr.	Otr.	Otr.	<u>Year</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	0	0	0	0	0			
Total	100.0%	100.0%	100.0%	100.0%	100.0%			

N/A = Not Available S = Sampling

(Continued)

SIS Prod., Mkt., & Tech. 0003781

Table 1 (Continued)

8K MOS EPROM Shipment Data, 1976–1985

Сотрапу	lst	2nd	3rd	4th			
	Qtr.	Otr.	Otr.	Otr.	<u>Year</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	_N/A	<u> N/A</u>	10	30	40		
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		
			1978				
	lst	2nd	3rđ	4th			
	Otr.	Otr.	Otr.	Otr.	Year		
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	0	0	0	0	0		
Total	100.0%	100.0%	100.0%	100.0%	100.0%		

N/A = Not Available

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Table 1 (Continued)

8K MOS EPROM Shipment Data, 1976-1985

	lst	2nd	3rd	4th			
Company	<u>Qtr.</u>	Otr.	Otr.	Otr.	<u>Year</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		•	s .				
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		
			1979				
	1st	2nd	3rd	4th			
	Otr.	Otr.	Otr.	Otr.	<u>Year</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

Table 1 (Continued)

8K MOS EPROM Shipment Data, 1976-1985

	1980						
	lst	2nd	3rd	4th			
Company	Otr.	Otr.	Otr.	Otr.	<u>Year</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	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				
	lst	2nd	3rd	4th			
	Otr.	Otr.	Otr.	Otr.	<u>Year</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	0	0	0	0	0		
Total	100.0%	100.0%	100.0%	100.0%	100.0%		

N/A = Not Available S = Sampling

Table 1 (Continued)

8K MOS EPROM Shipment Data, 1976–1985

	1981					
	lst	2nd	3rd	4th		
Company	<u>Otr.</u>	Otr.	Otr.	Otr.	<u>Year</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	0	0	0	0	0	
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	
			1981			
	lst	2nd	3rd	4th		
	Otr.	Otr.	Otr.	Otr.	<u>Year</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	0	0	0	0	0	
Total	100.0%	100.0%	100.0%	100.0%	100.0%	

Table 1 (Continued)

8K MOS EPROM Shipment Data, 1976–1985

	1982							
	lst	2nd	3rd	4th				
Company	Otr.	Otr.	Otr.	Otr.	<u>Year</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	0	0	0	0	0			
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			
			1982					
	lst	2nd	3rd	4th				
	Otr.	Otr.	Otr.	Otr.	<u>Year</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	0	0	0	0	0			
Total	100.0%	100.0%	100.0%	100.0%	100.0%			

Table 1 (Continued)

8K MOS EPROM Shipment Data, 1976–1985

	1983					
	lst	2nd	3rd	4th		
<u>Company</u>	Otr.	Otr.	Otr.	Otr.	<u>Year</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	0	0	0	_0	0	
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	
			1983			
	lst	2nd	3rd	4th		
	Otr.	Otr.	Otr.	Otr.	<u>Year</u>	
Market Share				•		
U.S.	100.0%	100.0%	100.0%	100.0%	100.0%	
Japan	0	0	0	0	0	
Europe	Q	0	0	0	0	
Total	100.0%	100.0%	100.0%	100.0%	100.0%	

Table 1 (Continued)

8K MOS EPROM Shipment Data, 1976-1985

,	1984					
	lst	2nd	3rd	4th		
Company	Otr.	Otr.	Otr.	Otr.	<u>Year</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	Ó	Û	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	0	0	0	0	0	
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	
			1984			
	lst	2nd	3rđ	4th		
	Otr.	Otr.	Otr.	Otr.	<u>Year</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%	

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

		•			
	lst	2nd	3rd	4th	
Company	Otr.	Otr.	Otr.	Otr.	<u>Year</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	_0	هـ	Q	<u>0</u>	_0
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
			1985		
	lst	2nd	3rd	4th	
	Otr.	Otr.	Otr.	Otr.	<u>Year</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%

Source: Dataquest May 1989

Table 2

16K MOS EPROM Shipment Data, 1976–1987

				1976		
	MOS	lst	2nd	3rd	4th	
Company	Process	Otr.	Qtr.	Otr.	Otr.	<u>Year</u>
AMD	N	N/A	N/A	N/A	N/A	N/A
Eurotechnique	Ç	N/A	N/A	N/A	N/A	N/A
Fairchild	N	N/A	N/A	N/A	N/A	N/A
Pujitsu	N	N/A	N/A	N/A	N/A	N/A
Bitachi	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.	19	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	19	N/A	N/A	N/A	N/A	N/A
SGS-Ates	N	N/A	N/A	N/A	N/A	N/A
Synertek	ĸ	N/A	N/A	R/A	N/A	N/A
Texas Instruments	N	N/A	N/A	N/A	5	5
Toshiba	N	<u>N/A</u>	N/A	N/A	<u>N/A</u>	N/A
	N	0	0	0	15	15
	С	0	0	0	0	0
Total		0	0	0	15	15
Percentage Change from Previous Quarter						
Cumulative Total		:0:	ć	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,	Q	0.	0.8	0.8
				1976		
		lst	2nd	3rd	4th	
		Otr.	Otr.	Otr.	Otr.	Year
Market Share						
U.S.		0	0	0	100.00	100.0%
Jepan		٥	0	0	0	0
Europe		<u>0</u>	<u>0</u>	<u>o</u>	0	0
Total		0	0	0	100.0%	100.00

S = Sampling N/A = Not Available

Table 2 (Continued)

16K MOS EPROM Shipment Data, 1976–1987

MOS			1977				
AND Eurotechnique C N/A		MOS	lst	2nd		4th	
Burotechnique	Company	Process	<u>Otr.</u>	Otr.	Otr.	Otr.	Year
Pairchild N N N/A N/A N/A N/A N/A N/A N/A N/A N/A	AMD	ม	N/A	N/A	N/A	N/A	N/A
Pujitsu N N/A N/A N/A N/A N/A N/A N/A N/A N/A N	Eurotechnique	c	N/A	N/A	N/A	N/A	N/A
### ### ### ### ### ### ### ### ### ##	Pairchild	N	N/A	N/A	N/A	N/A	N/A
Intel N 40 75 100 125 34 Matsushita N N/A N/A N/A N/A N/A N/A N/A N/A N/A N	Fujitsu	N	N/A	N/A	N/A	N/A	N/A
National State	Hitachi	ы	N/A	N/A	N/A	n/A	N/A
Mitsubishi N N/A N/A N/A N/A N/A N/A N/A N/A N/A N	Intel	Ŋ	40	75	100	1,25	340
Nostek	Matsushita	'n	n/A	N/A	N/A	N/A	N/A
Note	Mitsubishi		-			•	N/A
National Semi. Nati	Mostek			N/A	N/A	N/A	N/A
NEC	Motorola			N/A	N/A	H/A	N/A
NEC	National Semi.		,	n/A	,	N/A	N/A
Oki Electric B B/A		_	•		-	*	N/A
SGS-Ates N N/A N/A N/A N/A N/A N/A N/A N/A N/A N	NEC		•	N/A	H/A	n/a	N/A
Symmetric N			•	,			N/A
Texas Instruments N 20 25 30 55 13 Toshiba N N N N N N N N N N N N N	· _ · _ · _						N/A
N							N/A
N 60 100 130 180 47							130
Total 60 100 130 100 47 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 \$35.1 CMOS 0 0 0 0 0 Overall \$45.00 \$45.00 \$30.00 \$30.00 \$35.1 Revenue (\$M) 2.7 4.5 3.9 5.4 16. **Total 60 100 130 100.0% 100.0% 100.0% 100.0% 100.0% Japan 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Toshiba	N	N/A	N/A	<u>N/A</u>	<u>N/A</u>	<u>N/A</u>
Total 60 100 130 100 47 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 \$35.10 \$35.10 \$45.00 \$45.00 \$30.00 \$30.00 \$35.10 \$45.00 \$45.00 \$30.00 \$30.00 \$35.10 \$45.00 \$45.00 \$30.00 \$30.00 \$35.10 \$45.00 \$45.00 \$30.00 \$30.00 \$35.10 \$45.00 \$45.00 \$30.00 \$30.00 \$35.10 \$45.00 \$45.00 \$30.00 \$30.00 \$35.10 \$45.00 \$45.00 \$30.00 \$30.00 \$30.00 \$35.10 \$45.00 \$45.00 \$30.00 \$30.00 \$30.00 \$35.10 \$45.00 \$45.00 \$30.00 \$30.00 \$30.00 \$35.10 \$45.00 \$45.		N	60	100	130	180	470
Percentage Change from Previous Quarter 0 67% 30% 38% 38% Cumulative Total 75 175 305 485 ASPs: NMOS \$45.00 \$45.00 \$30.00 \$30.00 \$35.1 CMOS 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0		c	0	0	0	0	0
Previous Quarter 0 67% 30% 38% Cumulative Total 75 175 305 485 ASPs: NMOS 345.00 \$45.00 \$30.00 \$30.00 \$35.1 CMOS 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Total		60	100	130	180	47,0
Previous Quarter 0 67% 30% 38% Cumulative Total 75 175 305 485 ASPs: NMOS 345.00 \$45.00 \$30.00 \$30.00 \$35.1 CMOS 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Percentage Change from						
ASPs: NMOS			0	67%	30%	38%	
CHOS Overall \$45.00 \$45.00 \$30.00 \$30.00 \$35.10 Revenue (\$M) 2.7 4.5 3.9 5.4 16.	Cumulative Total		75	175	305	485	
Overall \$45.00 \$45.00 \$30.00 \$30.00 \$35.1 Revenue (\$M) 2.7 4.5 3.9 5.4 16.							\$35.11 0
1977 1st 2nd 3rd 4th Otr. Otr. Otr. Otr. Otr. Year			•	_	•	-	\$35.11
1st 2nd 3rd 4th Otr. Otr. Otr. Otr. Otr. Year	Revenue (\$M)		2.7	4.5	3.9	5.4	16.5
1st 2nd 3rd 4th Otr. Otr. Otr. Otr. Otr. Year					1977		
Otr. Otr. Otr. Otr. Otr. Year Market Share . <td< td=""><td></td><td></td><td>lst</td><td>2nd</td><td></td><td>4th</td><td></td></td<>			lst	2nd		4th	
U.S. 100.0% 100.0% 100.0% 100.0% 100.0 Japan 0 0 0 0			Otr.		Otr.		Year
Japan 0 0 0 0 0	Market Share						
	U.S.		100.0%	100.00	100.0%	100.0%	100.0%
Europe0000	Japan		0	0	0	0	0
	Europe		0	0	0	0	0
Total 100.0% 100.0% 100.0% 100.0% 100.0	Total		100.00	100.0%	100.0%	100.0%	100.09

N/A = Not Available

Table 2 (Continued)

16K MOS EPROM Shipment Data, 1976-1987

				1978		
	MOS	lst	2nd	3rd	4th	
Company	Process	Otr.	Otr.	Otr.	Otr.	<u>Year</u>
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
Pujitsu	N	N/A	N/A	N/A	5	5
Bitachi	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	٥
Mitsubishi	N	N/A	N/A	N/A	N/A	0
Mostek	Ħ	S	5	S	25	25
Motorola	N	N/A	S	10	90	100
National Semi.	N	N/A	N/A	S	s	0
	С	N/A	N/A	N/A	N/A	0
NEC	N	N/A	N/A	N/A	N/A	0
Oki Electric	38	N/A	N/A	N/A	N/A	0
SGS-Ates	Ŋ	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	<u>N/A</u>	<u>N/A</u>	<u>_s</u>	5	5
	N	350	650	465	905	2,370
	¢	0	0	0	0	<u> </u>
Total		350	650	465	905	2,370
Percentage Change from						
Previous Quarter		941	86%	(284)	954	
Cumulative Total		835	1,485	1,950	2,855	
ASPe: NMOS		\$28.00	\$25.00	\$25.00	\$15.00	\$21.62
C140S		. 0	0	0	0	0
Overal1		\$28.00	\$25.00	\$25.00	\$15.00	\$21.62
Revenue (\$M)		9.8	16.3	11.6	13.6	51.3
				1978		
		lst	2nd	3rā	4th	
		Otr.	Otr.	Otr.	Otr.	<u>Year</u>
Market Share						
U.S.		100.0%	100.0%	98.90	95.6%	98.14
Japan		0	0	1.1	4.4	1.9
₿ лtobe		<u>0</u>	0		0	0
Total		100.0%	100.0%	100.0%	100.0%	100.00

S = Sampling N/A = Not Available

Table 2 (Continued)

16K MOS EPROM Shipment Data, 1976-1987

				1979		
	MOS	lat	2nd	3rd	4th	
Company	Process	Otr.	Otr.	Otr.	Otr.	Year
AMD	N	N/A	s	5	10	15
Eurotechnique	C	N/A	N/A	N/A	N/A	0
Pairchild	n	N/A	N/A	N/A	N/A	0
Pujitsu	N	70	200	300	300	870
Hitachi	И	125	200	350	500	1,175
Intel	N	550	750	800	900	3,000
Matsushita	N	N/A	A/K	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	H/A	N/A	N/A	0
SGS-Ates	H	N/A	N/A	n/a	N/A	0
Synertek	×	n/A	N/A	N/A	S	0
Texas Instruments	ы	400	900	1,100	1,800	4,200
Toghiba	N	25	50	90	200	<u> 365</u>
	N	1,435	2,470	3,185	4,475	11,565
	С	0		0	0	0
Total		1,435	2,470	• 3,185	4,475	11,565
Percentage Change from						
Previous Quarter		594	720	294	414	
Cumulative Total		4,290	6,760	9,945	14,420	
ASPs: NMOS CMOS		\$17.00 0	\$22.00 0	\$19.00 0	\$17.00	\$18.62 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		
		lat	2nd	3rd	4th	
		Otr.	Otr.	Otr.	Otr.	Year
Market Share						
U.S.		84.0%	81.0%	75.2%	75.59	77.6%
Japan		16.0	19.0	24.8	24.5	22.4
Europe		0	0	0	0	0
Total		100.04	100.04	100.04	100.0%	100.0%

S = Sampling N/A = Not Available

Table 2 (Continued)

16K MOS EPROM Shipment Data, 1976–1987

		1980					
	MOS	lst	2nd	3rd	4th		
Company	Process	Otr.	<u>Otr.</u>	<u>Qtr.</u>	Otr.	<u>Year</u>	
AMD	N	25	50	100	175	350	
Burotechnique	¢	N/A	N/A	N/A	N/A	O O	
Pairchild	N	30	300	300	250	880	
Pujitsu	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	R/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	Ŋ	300	330	<u>350</u>	400	1,380	
	N	7,350	6,490	7,705	8,745	30,290	
	¢	0	0	0	0	0	
Total		7,350	6,490	7,705	8,745	30,290	
Percentage Change from							
Previous Quarter		64%	(12%)	19%	134		
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	Q	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	
				1980			
		lst	2nd	310	4th		
		Otr.	Otr.	Otr.	Otr.	<u>Year</u>	
Market Share							
v.s.		54.1%	65.1%	68.3%	65,84	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%	100.00	100.0%	100.0%	

S = Sampling N/A = Not Available

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

Table 2 (Continued)

16K MOS EPROM Shipment Data, 1976–1987

				1981		
	MOS	lst	2nd	3rd	4th	
Company	Process	Otr.	Otr.	Otr.	Otr.	Year
AMD	N	250	350	485	750	1,835
Eurotechnique	c	N/A	N/A	S	15	15
Pairchild	n	100	20	20	0	140
Pujitsu	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	ы	120	150	200	250	720
Mitaubishi	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	ő	ã	ā	- 0
Texas Instruments	n	2.200	2.500	2,200	2,200	9,100
Toshiba	N N	90	100	200	350	740
tosurpe						
	19	10,205	11,445	11,305	11,645	44,600
	С	0	0	0	15	15
Total		10,205	11,445	11,305	11,660	44,615
Percentage Change from					-	
Previous Quarter		179	124	(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	û	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
				1981		
		lst	2nd	3rd	4th	
		<u>Otr.</u>	Otr.	Otr.	Otr.	<u>Year</u>
Market Share						
tr.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		100.01	100.0	100.00	100.0	100.0%

S = Sampling

N/A = Not Available

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

Table 2 (Continued)

16K MOS EPROM Shipment Data, 1976-1987

				1982		
	MOS	lst	2nd	3rd	4th	
Company	Process	Otr.	otr.	Otr.	Otr.	Year
AMD	N	1,000	1,150	1,150	900	4,200
Burotechnique	c	100	400	500	600	1,600
Fairchild	N	٥	e e	0	0	q
<u>Fujitsu</u>	И	400	350	250	100	1,100
Ritacni	N	450	250	200	200	1,100
Intel	И	3,000	2,500	1,800	1,200	8,500
Matsushita	N	250	250	150	100	750
<u>Mitsubishi</u>	N	450	350	300	160	1,260
Mostek	Ŋ	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	H	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	<u> 550</u>	700	800	_2,200
Total		11,400	10,990	10,250	10,190	42,830
Percentage Change from			-			
Previous Quarter		(28)	(4%)	(7%)	(1%)	
Cumulative Total		100,725	111,715	121,965	132,155	
ASPa: NMOS CMOS		\$3.25 0	\$3.10 0	\$3.00 0	\$3.00 0	\$3.09
Overall		\$3.25	\$3.10	\$3.00	\$3.00	\$3.09
Revenue (\$M)		36.6	32.4	28.7	28.2	125.7
				1982		
		lat	2nd	3rd	4th	
		Otr.	Otr.	Otr.	Otr.	Year
Market Share						
u.s.		70.2%	67.4%	64.48	64.9%	66.8%
Japan		28.1	27.3	27.3	24.1	26.8
Burope		1.8	<u>5.3</u>	8.3	11.0	6.4
Total		100.0	100.0%	100.0%	100.0%	100.04

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

MOS EPROM—Data

Table 2 (Continued)

16K MOS EPROM Shipment Data, 1976–1987

		1983					
	MOS	lst	2nd	3rd	4th		
Company	Process	Otr.	Otr.	Otr.	Otr.	Year	
AMD	N	700	700	1,000	1,200	3,600	
Eurotechnique	c	200	200	200	200	800	
Fairchild	N	0	0	0	0	0	
Pujitsu	Ħ	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	И	180	120	160	130	590	
Mostek	N	200	150	150	50	550	
Motorola	N	50	80	30	Q	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	19	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	<u>550</u>	700	700	900	2,850	
Total	∴ -	10,100	11,800	12,440	11,730	46,150	
Percentage Change from							
Previous Quarter		-04	164	54	(6%)		
Cumulative Total		142,335	154,135	166,575	178,305		
ASPs: NMOS		\$3.00	\$3.15	\$3.25	\$3.35	\$3.19	
CNOS			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			
		lst	2nd	3rd	4th		
		Otr.	Otr.	Otr.	Otr.	Year	
Market Share							
U.S.		63.4%	63.0%	64.1%	72.0%	65.74	
Japan		29.8	28.6	27.8	18.6	26.1	
Europe		6.9	6.5	8.0	9.4	8.2	
Total		100.0%	100.0%	100.04	100.0%	100.0%	

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

MOS EPROM—Data

Table 2 (Continued)

16K MOS EPROM Shipment Data, 1976–1987

				1984		
	MOS	lst	2nd	3rd	4th	
Company	Process	Qtr.	Qtr.	Otr.	Otr.	Year
AMD	N	1,000	1,100	1,200	1,300	4,600
Pairchild	N	0	0	0	0	Û
Pujitsu	N	0	a	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
NBC	C N	700 1,350	700	550 95 0	400 700	2,350
			1,200			4,200
Oki Blectric SGS	n N	250 1,050	250 600	200 300	200	900
	A H	1,030	900	300	800	2,750 0
Synertek Texas Instruments	N	3.500	3,000	2.000	1.800	10.300
Thomson-Eurotechnique	č	200	250	250	250	950
Toshiba	Ň	0	0	0	0	0
			<u>`</u>	<u>·</u>		<u>~</u>
	N	10,430	9,180	7,305	6,950	33,865
	С	900	950	800	650	3,300
Total '	٠.	11,330	10,130	8,105	7,600	37,165
Percentage Change from						
Previous Quarter		(3%)	(114)	(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 (SM)		39.9	36.0	26.1	22.7	124.7
				1984		
		lst	2nd	3rd	4th	
		Otr.	Otr.	Otr.	Otr.	Year
		<u> </u>	2000	7	7000	Tear
Market Share						
u.s.		73.3%	75.5%	77.18	73.0%	74.7
Japan		15.7	16.1	16.1	13.2	15.4
Entobe		11.0	8.4	<u>6.8</u>	13.8	10.0
Total		100.0%	100.04	100.0%	100.0%	100.04

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

Table 2 (Continued)

16K MOS EPROM Shipment Data, 1976–1987

				1985	•	
	MOS	lst	2nd	3rd	4th	
Company	Process	Otr.	Otr.	Otr.	Otr.	Year
AMD	N	1,550	1,850	1,350	1,050	5,800
Fairchild	N	C	0	0	0	0
Pujitsu	N	0	Q	0	0	0
Hitachi	19	0	0	C	0	0
Intel	N	0	0	0	0	0
Matsushita	N	O.	Q.	0	0	0
Mitsubishi	N	50	50	0	0	100
Mostek	N	0	Ç	0	٥	0
Motorola	R	- 0	0	0	0	
National Semi.	N	1,800	1,600	1,500	1,200	6,100
NEC	C N	400 400	350 250	400 800	500 270	1,650 1,720
Oki Blectric	H	150	150	100	100	500
SGS	N	750	800	1,100	1,200	3,850
Synertek	n		0	0	2,200	0,000
Texas Instruments	N	1,500	1,500	1.600	1,600	6,200
Thomson-Eurotechnique	č	350	450	400	500	1,700
Toeniba	N	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		(90)	16	41	(114)	
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
				1985		
		lst	2nd	3rd	4th	
		Otr.	Otr.	Otr.	Otr.	Year
Market Share					_	
۳.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.

Table 2 (Continued)

16K MOS EPROM Shipment Data, 1976-1987

			1986					
		MOS	lst	2nd	3rd	4th	_	
Company		Process	Otr.	Otr.	Otr.	Otr.	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	
	**	¢	0	0	0	 º	0	
Total			5,036	3,809	3,330	2,490	14,665	
Percentage Change	from							
Previous Quarter			(22%)	(24%)	(134)	(25%)		
Cumulative Total			248,126	251,935	255,265	257,755		
ASPE: NMOS			\$2.35	\$2.40	\$2.40	\$2.50	\$2.40	
CMOS			Q	0	0	٥	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			
			lst	2nd	324	4th		
			Otr.	Otr.	Otr.	Otr.	<u>Year</u>	
Market Share								
U.S.			69.5%	73.5%	61.64	65.3%	68.0%	
Japan			3.6	5.8	2.4	1.6	3.5	
Europe			26.9	20.7	36.0	<u>33.1</u>	28.4	
Total			100.0%	100.0%	100.0%	100.0%	100.04	

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

Table 2 (Continued)

16K MOS EPROM Shipment Data, 1976–1987

				1987		
	MOS.	lst	2nd	329	4th	
Company	Process	<u>Otr.</u>	Otr.	Otr.	Ott.	<u>Year</u>
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	H	1,185	1,125	1,240	720	4,270
	C	15	70	30	75	190
Texas Instruments	H	200	200	150	150	700
41-4-14113	c	50	50	110	125	335
WaferScale	C	10		<u>75</u>	75	185
	10	2,125	1,865	1,940	1,390	7,320
	c	383	572	619	820	2,394
Total		2,500	2,437	2,559	2,210	9,714
Percentage Change from						
Previous Quarter		14	(3%)	5%	(244)	
Cumulative Total		260,263	262,700	265,259	267,469	
ASPs: NMOS		\$2.55	\$2.60	\$2.65	\$2.70	\$2.62
CHOS		34.60	\$2.90	\$3.10	\$3.30	\$3.36
Overall		\$2.86	\$2.67	\$2.76	\$2.92	\$2.80
Revenue (Sh)		7.2	6.5	7.1	6.5	27.2
				1987		
		lst	2nd	3rd	4th	
		Otr.	Otr.	Otr.	Otr.	Year
Market Share						
U.S.		50.6%	49.3%	48.44	62.70	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		100.04	100.0%	100.04	100.0%	100.0%

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

Source: Dataquest May 1989

Table 3

32K MOS EPROM Shipment Data, 1978–1987

				1978		_
	MOS	lst	2nd	3rd	4th	
Company	Process	Otr.	Otr.	Otr.	Otr.	Year
AMD	N	N/A	N/A	N/A	N/A	a
Eurotechnique	C	N/A	N/A	N/A	N/A	0
Pujitsu	N	N/A	N/A	N/A	N/A	0
_	С	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	Q
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	H/A	N/A	N/A	0
ŅEC	N	N/A	N/A	N/A	N/A	0
Rícoh	С	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	a
SGS-Atea	N	N/A	N/A	N/A	n/a	0
Texas Instruments	N	N/A	N/A	N/A	5	5
Toshiba	N	<u>N/A</u>	<u>n/a</u>	<u>N/A</u>	N/A	
	N	0	0	Q	5	5
	¢	<u>o</u>	<u>•</u>	<u>o</u>	<u>o</u>	0
Total		0	0	0	5	5
Descentage Change Ave	_					
Percentage Change fro Previous Quarter		0	0	0		
Previous Quarter		v	U	v	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 (\$A)		0	Q	0	0	0
				1978		
		lst	2nd	3rd	4th	
		Otr.	Otr.	Otr.	Otr.	Year
Market Share						
v.s.		0	0	0	0	0
Japan		٥	0	0	o	0
Europe		<u>o</u>	<u>0</u>	<u>o</u>	0	<u>o</u>
Total		0	0	o	0	0

S = Sampling N/A = Not Available

Table 3 (Continued)

32K MOS EPROM Shipment Data, 1978–1987

				1979		
	MOS	let	2nd	359	4th	_
Company	Process	Otr.	Otr.	Otr.	Otr.	Year
AMD	N	N/A	N/A	N/A	N/A	0
Eurotechnique	C	N/A	N/A	N/A	N/A	0
Pujitsu	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	Q
National Semi.	C	N/A	N/A	N/A	N/A	0
NEC	N	n/a	N/A	H/A	n/a	0
Ricoh	С	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.	H/A	N/A	N/A	N/A	0
Texas Instruments	N	10	35	60	90	195
Toshiba	n	<u>N/A</u>	<u>N/A</u>	<u>N/A</u>	<u>n/a</u>	
	N	15	65	110	190	380
	C	0	0	0	0	_0
Total		15	65	110	190	380
Percentage Change from		-				
Previous Quarter		0	3334	69%	73%	
Cumulative Total		20	85	195	385	
ASPs: NNOS		\$80.00	\$80.00	\$75.00	\$75.00	\$76.05
CMOS		0	0	0	Đ	0
Overall		\$80.00	\$80.00	\$75.00	\$75.00	\$76.05
Revenue (SM)		1.2	5.2	8.3	14.3	28.9
				1979		
		lst	2nd	3rd	4th	
		Otr.	Otr.	Otr.	Otr.	<u>Year</u>
Market Share						
v.s.		100.0%	100.00	100.0%	100.00	100.0%
Japan		0	0	0	0	0
Europe		0	0	0	0	0
Total		100.00	100.00	100.04	100.0	100.04

S = Sampling N/A = Not Available

Table 3 (Continued)

32K MOS EPROM Shipment Data, 1978–1987

			_			
	MOS	lst	2nđ	3rd	4th	
Company	Process	Otr.	Otr.	Otr.	Otr.	Year
AMD	n	N/A	N/A	s	2	2
Eurotechnique	c	N/A	N/A	N/A	N/A	0
Pujitsu	N	5	s	15	100	115
	C	N/A	N/A	N/A	N/A	Q
Hitachi	N	5	120	220	280	620
Intel	n	165	250	325	450	1,190
Mitsubishi	N	S	6	40	90	136
Motorela	И	5	30	60	50	145
National Semi.	ç	S	10	15	15	40
NEC	n C	N/A	N/A	5	15	20
Ricoh	N	n/a n/a	N/A N/A	N/A	N/A	0
Rockwell	Č.	N/A	N/A	n/A n/A	N/A N/A	٥
SGS-Ates	N	N/A	N/A	N/A	N/A	ŭ
Texas Instruments	n	150	300	350	450	1,250
Toshiba	N	N/A	<u>8</u>	5	10	15
1000220	••	<u> </u>	<u> </u>			
	N	320	706	1,020	1,447	3,493
	С	0	_10	15	<u> </u>	40
Total		320	716	1,035	1,462	3,533
Percentage Change from						
Previous Quarter		684	1249	45%	414	
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	28.3	30.6	14.5	90.9
				1980	_	
		lst	2nd	359	4th	
		Otr.	Otr.	Otr.	Otr.	Year
Market Share						
U.S.		100.0%	82.4%	72.5%	66.1%	74.4%
Japan		0	17.6	27.5	33.9	25.6
Burope		0	0	0	0	0
Total		100.0%	100.0%	100.0%	100.0%	100.0%

S = Sampling
N/A = Not Available

Table 3 (Continued)

32K MOS EPROM Shipment Data, 1978–1987

		1981					
	MOS	lst	2nd	310	4th		
Company	Process	Qtr.	<u>Qtr.</u>	Otr.	Otr.	Year	
AMD	N	10	100	120	310	540	
Burotechnique	С	N/A	N/A	S	5	5	
Pujitau	N	150	170	600	1,000	1,920	
	c	N/A	N/A	N/A	N/A	a	
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	¢	N/A	N/A	N/A	N/A	0	
Rockwell	N	N/A	N/A	N/A	N/A	0	
	С	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	
	С	10		30	35	95	
Total		2,110	2,755	4,545	6,885	16,295	
Percentage Change from							
Previous Quarter		44%	314	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	٥	0	
Overall		\$9.00	\$6.00	\$7.00	\$5.80	\$6.92	
Revenue (SM)		18.9	21.9	31.6	39.7	112.1	
				1981			
		lst	2nd	319	4th		
		Otr.	Otr.	Otr.	Otr.	Year	
Market Share							
u.s.		58.39	59.5%	51.79	47.8%	52.2%	
Japan		41.7	40.5	48.3	52.1	47.7	
Burope		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.

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

			_	1982		
	MOS	lst	2nd	3rd	4th	
Company	Process	Otr.	Otr.	Otr.	Otr.	<u>Year</u>
AMD	n	600	1,050	650	850	3,150
Eurotechnique	c	30	100	150	200	480
Pujitsu	N	600	700	1,000	1,200	3,500
-	c	N/A	N/A	N/A	5	0
Hitachi	B	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	И	N/A	N/A	N/A	N/A	0
	С	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	Ħ	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%	129	34	
LIGATORS MARICAL		204	274	221		
Cumulative Total		28,893	40,053	52,498	65,348	
ASPs: NMOS		\$6.00	\$5.50	\$5.00	\$4.75	\$5.25
CHOS		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		
		lst	2nd	3rd	4th	
		Otr.	Otr.	Otr.	Otr.	Year
Market Share						
u.s.		40.3%	39.0%	33.54	35.0%	36.6%
Japan		59.3	60.0	65.1	63.0	62.1
Burope		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.

Table 3 (Continued)

32K MOS EPROM Shipment Data, 1978–1987

		1983					
	MOS	lst	2nd	319	4th		
<u>Company</u>	Process	Otr.	Otr.	Otr.	Otr.	Year	
AMD	N	800	1,000	1,200	1,500	4,500	
Eurotechnique	c	200	300	400	400	1,300	
Pujitsu .	N	1,200	1,500	1,500	1,500	5,700	
-	c	10	25	50	50	135	
Bitachi	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	С	n/A	n/a	N/A	S	٥	
Rockwell	N	n/a	A/M	n/a	N/A	0	
	С	N/A	N/A	S	25	25	
SGS-Ates	8	50	100	100	100	350	
Texas Instruments	N	1,000	2,000	3,000	3,500	9,500	
Toshiba	N	<u>600</u>	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			1.74				
Previous Quarter		78	17%	24	0.6		
Cumulative Total		79,058	95,033	111,283	127,458		
ASPs: NMOS		\$4.50	\$4.00	\$3.75	\$3.75	\$3.98	
C290S		0	0	0	0	a	
Overall		\$4.50	\$4.00	\$3.75	\$3.75	\$3.98	
Revenue (\$M)		59.2	60.8	57.0	55.9	232.9	
				1983			
		lst	2nd	359	4th		
		Otr.	Otr.	Otr.	Otr.	Year	
Market Share							
U.S.		33.9	37.2%	43.10	47.18	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	100.04	100.0%	100.09	100.0%	

S = Sampling
N/A = Not Available

Table 3 (Continued)

32K MOS EPROM Shipment Data, 1978–1987

		1984					
	MOS	lst	2nd	D2E	4th		
Company	Process	Otr.	Otr.	Otr.	Otr.	Year	
AMD	N	1,600	1,800	2,200	2,200	7,800	
Pujitsu	И	1,600	1,800	1,500	1,200	6,100	
•	С	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	H	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	¢	S	S	50	100	150	
Rockwell	N	N/A	N/A	s	s	0	
	c	50	25	ō	ō	75	
SGS	Ŋ	200	350	600	1,000	2,150	
Texas Instruments	N	3,800	4,000	3,200	2,200	13,200	
Thomson-Eurotechnique	č	350	300	300	250	1,200	
Toshiba	N	300	1.50	50	25	525	
	••						
	N	14,300	14,350	12,700	10,975	52,325	
	С	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%)	14	(104)	(14%)	Ħ	
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			
		lst	2nd	3rd	4th		
		Otr.	Otr.	Otr.	Qtr.	Year	
		<u> </u>	0044	<u> 201-</u>	<u> 2000 - </u>	1401	
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	<u>5.7</u>	
Total		100.04	100.00	100.00	100.0%	100.0%	

S = Sampling N/A = Not Available

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

Table 3 (Continued)

32K MOS EPROM Shipment Data, 1978-1987

				1985		
	MOS	lst	2nd	3rd	4th	
Company	Process	Otr.	Otr.	Otr.	Otr.	<u>Year</u>
AMD	n	2,200	2,450	1,750	1,300	7,700
Pujitsu	n	800	600	300	250	1,950
•	c	250	250	250	150	900
Hitachi	N	900	700	400	400	2,400
Intel	39	1,800	1,500	1,500	1,500	6,300
Mitsubishi	N	650	1,000	450	300	2,400
Motorola	N	0	0	0	٥	0
National Semi.	С	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	19	800	700	850	1,000	3,350
Texas Instruments	N	1,800	1,600	1,500	1,200	6,100
Thomson-Eurotechnique	Ç	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
				1985		
		lst	2nd	359	4th	
		Otr.	Otr.	Otr.	Otr.	V4
		<u> 2011</u>	0011	7411	QCL.	Year
Market Share						
U.S.		58.6%	58.8%	59.0%	58.6%	58.74
Japan		31.1	30.8	27.0	23.2	28.5
Burope		10.3	10.4	14.0	18.2	12.8
Total		100.0%	100.0%	100.04	100.0%	100.0%

Table 3 (Continued)

32K MOS EPROM Shipment Data, 1978–1987

		1986					
	MOS	lst	2nd	3rd	4th		
Company	Process	Otr.	Otr.	Otr.	Otr.	Year	
AMD	n	950	850	675	450	2,925	
Pujit s u	N	150	50	0	0	200	
	Ç	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	Q	0	282	7	289	
National Semi.	c	400	300	300	300	1,300	
NEC	N	330	270	150	100	850	
Ricoh	Ç	50	50	0	٥	100	
SŒŚ	N	463	350	1,200	1,200	3,213	
Texas Instruments	Ŋ	1,000	1,000	1,100	1,500	4,600	
Thomson-Eurotechnique	С	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		(254)	(14%)	94	48		
Cumulative Total		230,011	234,931	240,288	245,845		
ASPs: NMOS		\$2.10	\$2.15	\$2.20	\$2.25	\$2.10	
CNOS		\$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			
		ist	2nd	3rd	4th		
		Otr.	Otr.	Otr.	Otr.	Year	
Market Share							
U.S.		67.9%	75.2%	62.1%	70.2%	68.79	
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%	100.04	100.00	

MOS EPROM—Data

Table 3 (Continued)

32K MOS EPROM Shipment Data, 1978-1987

				1987		
	MOS	lst	2nd	3rd	4th	
Company	Process	Otr.	Otr.	Otr.	Otr.	<u>Year</u>
AMD	N	400	450	475	510	1,835
Pujitsu	N	0	٥	0	0	0
	c	0	0	0	0	0
Bitachi	N	0	0	0	0	0
Intel	N	1,050	1,300	1,100	1,100	4,550
	OTP	Q	0	0	0	a
Mitsubishi	n	0	0	0	0	¢.
National Semi.	¢	750	750	744	628	2,872
NEC	N	100	20	20	10	150
Ricoh	c	0	.0	0	0	0
SGS-Thomson	Ŋ	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		(184)	(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		
		ļst	2nd	3rd	4th	
		Otr.	Otr.	Otr.	Otr.	<u>Year</u>
Market Share						
v.s.		81.1%	84.6%	86.0%	83.2%	83.6%
Japan		2.2	0.5	9.5	0.3	0.9
Europe		16.7	14.9	13.5	16.6	15.4
Total		100.0%	100.04	100.0%	100.0%	100.04

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

Source: Dataquest May 1989

Table 4

64K MOS EPROM Shipment Data, 1980-1987

				1980		
	MOS	ist	2nd	3rd	4th	
Company	Process	<u>Qtr.</u>	Otr.	<u>Qtr.</u>	Otr.	Year
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	ş	0
	С	N/A	N/A	N/A	N/A	0
Intel	N	A/K	N/A	N/A	S	0
	N	N/A	N/A	N/A	N/A	0
Mitsubishi	19	N/A	N/A	N/A	N/A	0
Mostek	29	N/A	N/A	N/A	Ş	0
Motorola	N	s	s	5	5	10
NEC	N	N/A	N/A	N/A	N/A	0
	c	N/A	N/A	N/A	A/K	อ
Oki Blectric	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
	¢	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	G
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	Q
Texas Instruments	N	N/A	8	10	20	30
Toshiba	N	N/A	N/A	N/A	N/A	0
VLSI Technology	č	, N/A	N/A	N/A	N/A	Ŏ
WaferScale	N	N/A	N/A	N/A	N/A	_ 0
METELOGIE		<u>197 ft</u>	<u> </u>	<u> </u>	<u>17 A</u>	
	N	0	0	15	25	40
	С	0	<u>o</u>	_ •	-0	
Total		0	0	15	25	40
Percentage Change from						
Previous Quarter		0	0	0	67%	
Cumulative Total		Q	0	15	40	
ASPa: NMOS		0	٥	0	0	0
CHOS		ŏ	ō	ŏ	ŏ	ō
Ovecall		\$200.00	\$100.00	\$80.00	\$70.00	\$73.75
Revenue (\$M)		•	•	1.2	1.8	3.0
				1980		
		lst	2nd	3rd	4th	
		Otr.	Otr.	Otr.	Otr.	Year
Market Share						
u.s.		0	0	100.0%	100.0%	100.0%
Japan		0	Ō	0	0	Ò
Entobe		<u>o</u>	Ō	0	0	
Total		σ	0	100.04	100.0%	100.0%
S = Sampling N/A = Not Available	·		1~			

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

		1981				
_	MOS	lst	2nd	354	4th	
Company	Process	Otr.	Otr.	Otr.	Otr.	<u>Year</u>
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
Intel	C N	N/A 10	N/A 70	N/A 200	N/A 500	0 780
Incer	N	N/A	N/A	N/A	N/A	0
Mitsubishi	N	N/A	N/A	N/A	S	ŏ
Mostek	N	3	2	5	3	10
Motorola	N	15	40	30	50	135
NEC	N	N/A	N/A	N/A	S	0
	С	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	H/A	N/A	0
Rockwell	N	N/A	N/A	N/A	N/A	0
4504	C	N/A	N/A	N/A	N/A	0
SEEQ	N C	N/A	N/A	N/A	N/A	0
Seiko-Epson SGS-Ates	N	n/a n/a	n/a n/a	N/A N/A	N/A N/A	0
Sharp	č	N/A	N/A	N/A	N/A	ő
Signetics	č	N/A	N/A	N/A	N/A	ŏ
Texas Instruments	N	30	65	100	100	295
Toshiba	И	N/A	N/A	N/A	N/A	0
VLSI Technology	C	N/A	N/A	N/A	N/A	0
WaferScale	29	N/A	N/A	<u>N/A</u>	N/A	0
	N	55	180	355	778	1,368
	c	_0	0	0	0	0
Total		55	180	355	778	1,368
B						
Percentage Change from		3 344	2276		1100	
Previous Quarter		120%	227%	97%	119\$	
Cumulative Total		95	275	630	1,408	
ASPs: NMOS		0	0	0	0	0
CMOS		a	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
•				1981		
		lst	2nd	3rd	4th	
		Otr.	Otr.	Otr.	Qtr.	Year
Market Share						
U.S.		100.04	98.3%	94.4%	83.9%	89.2%
Japan		G	1.7	5.6	16.1	10.8
Europe		0	0	0	0	0
Total		100.04	100.0%	100.0%	100.0%	100.0%
S = Sampling N/A = Not Available						

N/A = Not Available

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

	1982								
	MOS	lst	2nd	3rd	4th				
Company	Process	Otr.	Otr.	Oct.	Otr.	<u>Year</u>			
AMD	N	\$	10	250	500	760			
Pujitsu	Ŋ	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	N/A	N/A	N/A	N/A	1 016			
Mitsubishi Mostek	n N	5 0	15 0	500 0	1,400 0	1,915			
Motorola	N	60	100	100	100	0 360			
NEC	N ·	S	10	60	200	270			
M13-C	Ĉ	N/A	N/A	N/A	N/A	0			
Oki Blectric	Ň	N/A	N/A	N/A	Š	ŏ			
Ricob	č	N/A	N/A	N/A	N/A	ō			
Rockwell	N	N/A	N/A	N/A	N/A	ŏ			
_	C	N/A	N/A	N/A	N/A	Ó			
see <u>o</u>	N	N/A	S	5	15	20			
Seiko-Epson	¢	R/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	Ç	N/A	n/a	N/A	N/A	0			
Texas Instruments	N	100	700	100	100	400			
Toshiba	N	N/A	S 45	20	50	70			
VLSI Technology	C	N/A	N/A	N/A	N/A	0			
MaferScale	N	<u> </u>	<u> N/A</u>	<u> N/A</u>	<u> N/A</u>	0			
	N	1,460	3,185	5,635	7,665	17,945			
	С	10	25	50	100	185			
Total		1,470	3,210	5,685	7,765	18,130			
Percentage Change from		•							
Previous Quarter		894	1189	77%	378				
Cumulative Total		2,878	6,088	11,773	19,538				
•		4,010	******		,				
ASPs: NMOS		0	0	0	0	0			
CMOS		0	0	٥	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			
•				1982_					
		lst	2nd	319	4th				
		Otr.	Otr.	Otr.	Otr.	Year			
Market Share									
r.s.		65.3%	59.54	52.04	41.48	49.9%			
Japan		34.7	40.5	48.0	58.6	50.1			
Europe		0	0	0	0	0			
Total		100.00	100.0%	100.0	100.0%	100.0%			
S = Sampling N/A = Not Available		•			-				

Table 4 (Continued)

64K MOS EPROM Shipment Data, 1980–1987

				1983		
	MOS	lst	2nd	3rd	4tn	
Company	Process	Otr.	Otr.	Otr.	Otr.	Year
AMD	N	600	900	1,300	1,800	4,600
Pujitsu	N	2,200	2,400	2,500	3,000	10,100
	С	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
	И	N/A	N/A	N/A	A/K	Q
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
Ohi Blancaia	c	N/A	N/A	N/A	N/A	0
Oki Electric Ricoh	N C	25 N/A	50 N/A	100 N/A	200	375 0
Rockwell	N	N/A	N/A	N/A	N/A N/A	0
MOCKWELL	Č	N/A	N/A	N/A	N/A	ŏ
SEEQ	N N	25	100	310	600	1,035
Seiko-Epson	Ĉ	N/A	N/A	N/A	N/A	1,033
SGS-Ates	N	N/A	N/A	N/A	S	0
Sharp	Č	N/A	N/A	N/A	N/A	0
Signetics	č	N/A	N/A	m/a S	S S	Ů
Texas Instruments	N	400	800	1,500	2,000	4,700
Toshiba	N	200	400	400	600	1,600
VLSI Technology	č	N/A	N/A	N/A	N/A	2,000
WaferScale	N	N/A	N/A	N/A	N/A	<u>`</u>
	n	10,150	13,150	17,760	22,300	63,360
	¢	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
				1983		*
		lst	2nd	3rd	4th	
		Otr.	Otr.	Otr.	Otr.	Year
Market Share						
U.S.		40.1%	40.9%	41.6%	37.8%	39.94
Japan		59.9	59.1	58.4	62.2	60.1
Entobe		0	0	0	0	0
Total		100.0%	100.0%	100.0%	100.06	100.0%
S = Sampling						

S = Sampling N/A = Not Available

Table 4 (Continued)

64K MOS EPROM Shipment Data, 1980-1987

			1984			
	MOS	lst	2na	3rd	4th	
Company	Process	Qtr.	Otr.	Otr.	Otr.	<u>Year</u>
AMD	n	1,200	1,300	1,600	1,700	5,800
Fujitsu	Ŋ	2,500	2,800	3,000	3,000	11,300
	c	500	600	700	900	2,700
Bitachi	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
and manage	C N	N/A	N/A	N/A	3	0
Oki Electric	C	400	600	500	400	1,900
Ricoh	_	N/A	0	25	100	125
Rockwell)) (10	0	0	10
6770	ć.	10	50	0	0	60
SBEQ	N	800	1,000	1,050	1,100	3,950
Seiko-Epson	c :	N/A	N/A	N/A	N/A	0
SGS	N C	50	150	350	600	1,150
Sharp	c	H/A	N/A	N/A	N/A	0
Signetics	n	S 400	10	10	10	30
Texas Instruments	N	2,400	2,600	2,800	2,400	10,200
Toshiba	C	400	1,200	800	500	2,900
VLSI Technology WaferScale	N	N/A	N/A	N/A	N/A	0
MSTSTSCSTS	N	N/A	N/A	N/A	<u> </u>	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 fr						
Previous Quarter	_	(7%)	21%	31	(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 (SM)		116.5	143.1	134.1	117.3	511.1
				1984		_
		lst	2nd	3rd	4th	
		Otr.	Otr.	Otr.	Otr.	Year
Market Share						
U.S.		34.79	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%	100.04

S = Sampling

N/A = Not Available

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

Table 4 (Continued)

64K MOS EPROM Shipment Data, 1980–1987

				1985		
	MOS	lst	2nd	3rd	4th	
Company	Process	Otr.	Otr.	Otr.	Otr.	Year
AMD	N	2,100	1,550	1,825	1,150	6,625
Pujitsu	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
	¢	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 N	400	300	300	400	1,400 6,150
NEC	C	1,250 40	1,450 200	1,650 350	1,800 300	890
Oki Electric	N	350	300	200	150	1,000
Ricoh	Ĉ	200	250	250	150	850
Rockwell	ŭ	200	0	0	- 0	0
100411622	č	ŏ	ŏ	ŏ	ō	ŏ
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	¢	N/A	N/A	N/A	s	0
Signetics	C	0	0	0	0	0
Texas Instruments	M	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	<u>s</u>	10	10
	N	25,080	21,925	24,075	22,825	93,905
	С	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		34	(114)	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		
		lst	2nd	3ca	4th	
		Qtr.	Otr.	Otr.	Otr.	Year
Market Share						
v.s.		30.0%	31.3%	29.2%	28.19	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.

Table 4 (Continued)

64K MOS EPROM Shipment Data, 1980-1987

				1986		
	⊯os	lst	2nd	310	4th	
Company	Process	Otr.	Otr.	Otr.	Otr.	<u>Year</u>
AMD	N	850	800	900	1.385	3.935
Pujitsu	N	1,500	1,500	2,000	4,000	9,000
	Ċ	1,000	1,000	2.000	4,000	8,000
General Instruments	č	5	0	31	170	201
deligital filocidiments	OTP	N/A	N/A	S	10	10
Gold Star	C	*/ S	5	0	5	5
Hitachi	Й	5,400	5,000	4.500	4,000	18,900
41-40111	ċ	700	700	700	700	2,800
Hyundai	č	s	s	0	5	5
Intel	N	3,400	3,300	2,400	3.200	12.300
111041	ĉ	250	500	425	400	1,575
	N OTP	400	400	300	200	1,300
	COTP	0	30	130	100	260
Mitsubishi	N	3,226	3,339	3,459	2,810	12.834
77.0000011	OTP	775	43	564	511	1,893
Motorola	N	147	346	177	114	784
Wordford	OTP	66	87	54	22	229
National Semi.	c	25	75	150	200	450
NBC	H	1.850	1.000	300	150	3.300
NPC		800	1,000	490	300	2,590
	027	240	140	100	50 50	530
Ricoh	C	440	140	25	50 50	75
SEED	N	525	615	315	150	1,605
Seiko-Epson	ç	0	75	100	150	325
SGS	N	552	608	2,500	2,500	6.160
Sharp	Č	372 0	5	2,500 10	2,500 15	30
Strach	OTP	S	ŝ	- 0	0	90
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
10+0106	OTP	100	400	500	500	
VLSI Technology	C	40	40	40		1,500
WaferScale	Č		10		50	170
Others	č			10	10	30
Others			0	<u>_</u> 5	5	<u> 10</u>
	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	22.018			
10541		23,/40	23,018	24,590	28,272	99,626
B						
Percentage Change from Previous Quarter		(54)	(3%)	. 79	154	
breatons Angreat		(34)	(34)	7.4	134	
Cumulative Total		308,184	331,202	355,792	384,064	
ASPs: NMCS		\$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
				1986		
		lst	2nd	.3rd	4th	
		Otr.	Otr.	Otr.	Otr.	Year
Market Share						
U.S.		29.9%	33.14	27.48	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	100.04	100.0%	100.0%
		100104	200.07	_00.04	400.04	100.01
S = Sampling						

S * Sampling N/A * Not Available

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

Table 4 (Continued)

64K MOS EPROM Shipment Data, 1980--1987

				1987		
	MOS	lst	2nd	3rd	4th	
Company	Process	Otr.	Otr.	Otr.	Otr.	<u>Year</u>
AMD	N	1,300	1,500	1,170	1,600	5,570
Cypress	C	50	75	100	100	325
Pujitsu	N	400	1,000	1,000	1,000	3,400
_	c	1,800	2,000	2,200	2,200	8,200
Gold Star	С	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
Byundai	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	256	1,050
	COTP	200	250	200	200	850
Microchip Tech., Inc.	c	100	299	202	632	1,233
	OTP	10	20	50	100	180
Mitsubiehi	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
	COTP	N/A	N/A	N/A	S	0
NEC	N	400	60	70	0	530
•	¢	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	С	50	50	100	100	300
SEEQ	N .	200	200	200	200	800
Seiko-Epson	С	100	100	100	100	400
SGS-Thomson	N	870	1,645	2,080	2,100	6,695
	С	80	110	40	100	330
	COTP	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	700	100	100	375
WaferScale	С	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

Table 4 (Continued)

64K MOS EPROM Shipment Data, 1980-1987

	1987							
	lst	2nd	3cd	4th				
	Otr.	Otr.	Otr.	Otr.	Year			
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					
	let	2nd	3rd	4th				
	Otr.	Otr.	Otr.	Otr.	<u>Year</u>			
Market Share								
Ţ.S.	32.8%	37.99	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	<u>0.1</u>	0.3	0.6	0.1	0.3			
Total	100.0%	100.0%	100.0%	100.0%	100.00			

S = Sampling N/A = Not Available Note: Columns may not add to totals shown because of rounding.

Source: Dataquest May 1989

Table 5
128K MOS EPROM Shipment Data, 1982–1987

				1982		
	MQS	lst	2nd	3rd	4th	-
Совралу	Process	Otr.	Otr.	Otr.	Otr.	Year
AND	N	N/A	N/A	N/A	s	0
Pujitsu	n	N/A	A/N	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	216
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	H/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	<u>N/A</u>	<u>N/A</u>	<u>N/A</u>	<u>N/A</u>	N/A
	×	3	15	· 55	155	226
	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		
		lst	2nd	3rd	4th	
		Otr.	Otr.	Otr.	Otr.	<u>Year</u>
Market Share						
v.s.		100.0%	100.0%	100.00	100.00	100.00
Japan		0	0	٥	0	0
Europe		0	0	0		0
Total		100.0%	100.0%	100.0%	100.0%	100.0%

S = Sampling N/A = Not Available

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

			1983					
	MOS	lst	2nd	3rd	4th			
Company	Process	Otr.	Otr.	Otr.	Otr.	Year		
AMD	N	50	175	300	500	1,025		
Fujit s u	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	H	S	10	10	10	30		
	С	N/A	N/A	n/a	N/A	0		
NEC	N	s	10	20	100	130		
seeq	N	H/A	S	50	100	150		
Texas Instruments -	N	0	a	O.	0	0		
	C	n/A	N/A	N/A	N/A	0		
Toshiba	N	<u> </u>	10	20	50	80		
	N	520	1,105	1,900	2,960	6,485		
	С	0	10	25	35	70		
Total		520	1,115	1,925	2,995	6,555		
Percentage Change from Previous Quarter		2354	1148	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		
				1983				
		lst	2nd	3£d	4th			
		Qtr.	Otr.	Otr.	Otr.	Year		
Market Share								
U.S.		96.28	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		100.00	100.0%	100.00	100.0%	100.0%		

S = Sampling N/A = Not Available

MOS EPROM—Data

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

		1984					
	MOS	lst	2nd	3rd	4th		
Company	Process	Otr.	Otr.	<u>Otr.</u>	Otr.	Year	
AMD	N	500	800	850	900	3,050	
Pujitsu	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	7,600	
Mitsubishi	N	60	400	1,500	2,200	4,160	
	С	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	
	¢	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	
	С	50	<u> 75</u>	100	100	325	
Total		3,590	6,310	8,600	11,400	29,900	
Percentage Change from Previous Quarter		204	764	361	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 (SM)		55.4	89.2	106.1	114.8	365.5	
				1984			
		lst	2nd	3rd	4th		
		Otr.	Otr.	Otr.	Otr.	Year	
Market Share							
v.s.		60.2%	44.8%	36.0%	32.5%	39.4%	
Japan		39.6	55.2	64.0	67.5	60.6	
Europe		0	0	0	0	0	
Total		100.0%	100.00	100.0%	100.00	100.0%	

S = Sampling N/A = Not Available

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

	MOS	lst	2nd	3rđ	4th	
Company	Process	Otr.	Otr.	Ott.	Otr.	Year
AMD	N	1,150	950	850	900	3,850
Fujitsu	В	1,000	1,500	1,750	2,000	6,250
•	С	100	100	100	100	400
Bitachi	N	3,000	3,200	3,500	3,100	12,800
Intel	Ŋ	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	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	<u>550</u>
Total		11,980	13,085	14,410	16,350	55,825
Percentage Change from						
Previous Quarter		54	9%	104	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		
		lst	2nd	310	4th	
		Otr.	Otr.	Otr.	Otr.	<u>Year</u>
Market Share						
v.s.		29.8%	23.5%	21.54	20.5%	23.5%
Japan		70.2	76.5	78.5	79.5	76.5
Europe		<u> </u>	0	0	0	0
Total		100.0%	100.04	100.0%	100.0%	100.04

S = Sampling N/A = Not Available

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

				1986		
	MOS	lst	2nd	3ra	4th	
Company	Process	Otr.	Otr.	Otr.	Otr.	Year
AMD	N	1,300	1,100	1,050	1,715	5,165
Pujitsu	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
	COTP	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	¢	s	0	5	5	10
Others	C	<u> N/A</u>	s	5	10	15
*:	N	14,835	14,735	13,085	12,780	55,435
•	¢	280	355	455	805	1,895
Total		15,115	15,090	13,540	13,585	57,330
Percentage Change from			•	42.00	_	
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
CHOS		\$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
				1000		
		lst	2nd	1986	4th	
				3rd		¥
		Otr.	Otr.	Otr.	Otr.	Year
Market Share						
v.s.		27.34	31.2%	37.4%	42.9%	34.4%
Japan		72.7	68.8	62.6	57.0	65.6
Europe			0.0	0.0	0.1	0.0
Total		100.0%	100.04	100.04	100.0%	100.00

S = Sampling N/A = Not Applicable

Table 5 (Continued)

128K MOS EPROM Shipment Data, 1982–1987

	MOS	lst	2nd	3rd	4th	
Çompany	Process	Otr.	Otr.	Otr.	Otr.	Year
AMD	N	1,300	1,925	1,725	1,900	6,850
Pujitsu	N	1,000	1,200	1,100	1,100	4,400
	c	600	800	900	900	3,200
Hitachi	ы	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
	¢	0	100	250	300	650
	C OTP	0	0	20	20	40
Microchip Tech., Inc.	С -	141	227	420	741	1,529
	COTP	20	45	80	228	373
Mitsubishi	N	1,150	1,300	1,400	950	4,800
	Ç	40	100	130	60	330
	N OTP	120	250	300	100	770
	C OTP	0	0	0	0	0
National Semi.	¢	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	Ç	0	0	0
SEEQ	N	150	150	100	100	500
Seiko-Epson	n	Q	10	15	25	50
SGS-Thomson	N	180	525	1,160	1,700	3,565
Texas Instruments	N	0	2\$	25	70	120
	¢	800	950	1,100	1,200	4,050
Toshiba	N	500	500	1,000	1,000	3,000
	N OTT	900	1,000	1,000	1,200	4,100
VLSI Technology	c	5	10	10	10	35
WaferScale	c	<u>s</u>			5	10
	N	11 200	10 476	11,575	10.000	45 33 5
	C	11,300	12,475		10,965	46,315
	Ç	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%	(14)	14	
Cumulative Total		162,966	177,864	192,577	207,396	
ASPs: NMOS		\$3.00	\$3.35	83.45	\$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		
		lst	2nd	324	4th	
		Qtr.	Otr.	Otr.	Otr.	<u>Year</u>
Naghat Chauc						
Market Share		43 00	43.46	36 60	40.50	42 00
v.s.		42.9%	43.44	36.64	49.6%	43.20
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

Table 6
256K MOS EPROM Shipment Data, 1983-1987

MOS Process N N C N C N C N C N C N C N C N C N C	Ist Otr. N/A N/A N/A N/A N/A N/A N/A	Ind Otr. S N/A N/A S N/A N/A N/A N/A N/A	3rd <u>Qer.</u> 10 M/A N/A 5 M/A M/A M/A M/A M/A M/A	4th <u>Qtr.</u> 25 N/A N/A 20 N/A N/A N/A N/A N/A N/A	Year 35 0 0 25 0 0 0 0
N N C N C N C N C N C N C N C N C N C N	H/A H/A H/A N/A S H/A H/A H/A H/A	S N/A N/A N/A S N/A N/A N/A 10	10 N/A N/A 5 N/A N/A N/A N/A	25 N/A N/A N/A 20 N/A N/A N/A 90	35 6 6 25 6 6
N C N C N C N C N C	N/A N/A N/A N/A N/A N/A N/A N/A	N/A N/A N/A S N/A N/A N/A N/A N/A	N/A N/A N/A 5 N/A N/A N/A N/A N/A	N/A N/A N/A 20 N/A N/A N/A N/A 90	25 0 0 0 0 0 0
C N G N C N C N C N C	N/A N/A S N/A N/A N/A N/A N/A	8/A 8/A 8/A 8/A 8/A 8/A 10 8/A	N/A N/A 5 N/A N/A N/A N/A 35	N/A N/A 20 N/A N/A N/A N/A 90	0 0 25 0 0
N C N C N C N C	N/A S N/A N/A N/A S N/A N/A	N/A S N/A N/A N/A 10 N/A N/A	N/A 5 N/A N/A N/A N/A 35 N/A	N/A 20 N/A N/A N/A N/A 90	25 0 0 0
C N C N C N C N C	S N/A N/A N/A S/A N/A N/A	S N/A N/A N/A 10 N/A N/A	5 N/A N/A N/A N/A 35 N/A	20 N/A N/A N/A N/A 90	25 () ()
N C N C N C N C	N/A N/A N/A N/A N/A N/A	N/A N/A N/A 10 N/A N/A	N/A N/A N/A N/A 35 N/A	N/A N/A N/A N/A 90	0
C N C N C N C	N/A N/A N/A 5 N/A N/A	H/A H/A H/A 10 H/A H/A	N/A N/A N/A 35 N/A	N/A N/A N/A 90	0
n C N C N C	N/A B/A 5 N/A N/A	M/A N/A 10 H/A N/A	N/A N/A 35 N/A	N/A N/A 90	0
С И С И С	8/A 5 N/A N/A	N/A 10 N/A N/A	N/A 35 N/A	N/A 90	(
N C N C	5 N/A N/A N/A	10 N/A N/A	35 N/A	90	
C N C	n/A n/A n/A	n/a n/a	N/A		140
N C N C	n/A N/A	N/A		N/A	
C N	N/A		kt /N		(
N C			M/A	S	(
С	M /2	N/A	N/A	N/A	(
	N/A	N/A	N/A	8	(
	N/A	n/a	N/A	N/A	(
	N/A	H/A	n/a	N/A	(
C	N/A	N/A	N/A	N/A	(
Ħ	N/A	N/A	N/A	N/A	
С	N/A	N/A	N/A	N/A	0
n	n/a	N/A	N/A	N/A	0
¢	N/A	N/A	N/A	N/A	0
	N/A	N/A	N/A	N/A	0
C	N/A	N/A	N/A	N/A	
N	5	10	45	115	175
¢	<u> </u>	0	5		
	5	10	50	135	200
	0	100%	400%	170*	
	5	15	65	200	
	\$150	\$125	\$100	\$95	\$100
	0	0	\$145	\$115	\$121
	\$150	\$125	\$105	\$98	\$102
	0.8	1.3	5.2	13.2	20.5
			1983		
	lst	2nd	3rd	4th	
	Otr.	Otr.	Otr.	Otr.	Year
	100.0%	100.0%	90.0%	85.2%	87.5%
	0	0	10.0	14.8	12.5
	0	0	0	<u>0</u>	0
	100.0%	100.0%	100.0%	100.04	100.0%
	0 0 N 0 0 0	C N/A C N/A N N/A C N/A N N/A C N/A C N/A C N/A C N/A C S 5 \$150 0 \$150 0.8	C N/A H/A C N/A N/A N N/A N/A C N/A N/A N 5 10 C 0 0 0 100% 5 15 \$150 \$125 0 0 \$125 0 1.3	C N/A N/A N/A N/A C N/A N/A N/A N/A N N/A N/A N/A N N/A N/A N/A N N/A N/A N/A N N/A N/A N/A C N/A N/A N/A N 5 10 45 C 0 0 5 5 10 50 0 100% 400% 5 15 65 \$150 \$125 \$100 0 0 \$145 \$150 \$125 \$105 0.8 1.3 5.2 1983 lst 2nd 3rd Qtr. Qtr. 100.0% 100.0% 90.0% 0 0 10.0 0 0 0	C N/A N/A N/A N/A N/A C N/A N/A N/A N/A N/A N N/A N/A N/A N/A C N/A N/A N/A N/A N 5 10 45 115 C 0 0 5 20 5 10 50 135 0 100% 400% 170% 5 15 65 200 \$150 \$125 \$100 \$95 0 0 \$145 \$115 \$150 \$125 \$105 \$98 0.8 1.3 5.2 13.2 1983 lst 2nd 3rd 4th Otr. Otr. Otr. 100.0% 100.0% 90.0% 85.2% 0 0 10.0 14.8 0 0 0 0

S = Sampling N/A = Not Available

Table 6 (Continued)
256K MOS EPROM Shipment Data, 1983-1987

				1984		
	MOS	lst	2nd	3rđ	4th	
Company	Process	Otr.	Otr.	Otr.	Otr.	Year
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
Pujitsu	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	Q
Hitachi	H	n/a	N/A	Ş	S	0
	С	N/A	n/A	S	S	0
Intel	N	150	250	375	475	1,250
	Ç	N/A	N/A	N/A	n/A	0
Mitsubishi	N	S	s		5	5
National Semi.	¢	N/A	N/A	N/A	N/A	0
NEC	N		S	\$	5	5 0
	C	N/A	N/A	N/A	n/a	U
SEEQ.	C	R/A	8	8		5
Seiko-Epeon	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	\$	\$	0 0
VLSI Technology	c c	N/A	N/A	n/a	N/A	_
WaferScale '	C	<u>N/A</u>	_	-	_	0
	N	260	410	525	845	2,040
	¢	<u>30</u>	40	_50	80	200
Total		290	450	575	925	2,240
Percentage Change from						
Previous Quarter		115\$	554	28%	61%	
Cumulative Total		490	940	1,515	2,440	
ASPs: NMOS		\$75.00	\$45.00	\$35.00	\$28.00	\$39.21
CHOS		\$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
				1984		
•		lst	2nd	3rd	4th	
		Otr.	Otr.	Otr.	Otr.	<u>Year</u>
Market Share						
U.S.		86.29	84.4%	82.6%	78.9%	81.9%
Japan		13.8	15.6	17.4	21.1	18.1
Europe		0	0	0		0
Total		100.0%	100.0%	100.0%	100.0%	100.0%

S = Sampling N/A = Not Available

Table 6 (Continued)
256K MOS EPROM Shipment Data, 1983-1987

				1985	_	
	MOS	lst	2nd	3rā	4th	
Company	Process	Otr.	Otr.	Otr.	Otr.	<u>Year</u>
AMD	N	450	800	950	950	3,150
Atmel	N	n/a	N/A	N/A	S	٥
	С	N/A	N/A	N/A	S	٥
Pujitsu	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
Ritachi	N	50	200	500	800	1,550
	С	S	25	150	300	475
Intel	N	1,000	1,800	2,400	2,700	7,900
	С	N/A	s	50	100	150
Mitsubishi	N	5	25	70	600	700
National Semi.	c	s	S	S	10	10
NEC	Ŋ	30	230	550	750	1,560
	c		50	150	200	400
SEEQ	c	15	110	180	250	555
Seiko-Epson	Ç	N/A	N/A	N/A	\$.0
SGS	N	N/A	N/A	Ş	10	10
Texas Instruments	c	N/A	N/A	8	50	50
Toshiba	Ŋ	150	350	550	700	1,750
	c	150	200	300	425	1,075
VLSI Technology	c	N/A	S	25	50	75
WaferScale	С	<u> N/A</u>	<u>N/A</u>		<u>s</u>	0
	n	1,710	3,605	5,420	7,185	17,920
	c	315	<u>635</u>	1,255	<u>1,995</u>	4,200
Total		2,025	4,240	6,675	9,180	22,120
Percentage Change from						
Previous Quarter		350€	109%	579	388	
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 (SM)		43.7	51.8	37.5	42.5	175.5
				1985		
		lst	2nd	3rd	4th	
		Otr.	Otr.	Otr.	Otr.	Year
Market Share						
U.S.		72.3%	63.9%	54.04	45.29	53.94
Japan		27.7	36.1	46.0	54.7	46.0
Entobe					0.1	0
Total		100.0%	100.0%	100.00	100.04	100.0%

S = Sampling

N/A = Not Available

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

Table 6 (Continued)

256K MOS EPROM Shipment Data, 1983–1987

70,006	20,047	17,943	11,294	14,/22		TOCAL
30 00x	30 047	17 043	17 204	14 777	(Total
_	F 737	4 307	л Я	3 143	3	
53,838	14,810	13,736	13,712	11,580	×	
	ло	un o	un o	UN (Ca. s	
	.	5 (5 (- (z . (Others
	л :	, s	л [;]	va.	n.	WaferScale
	50	50	50	50	റ	VLSI Technology
	200	200	200	100	C OIP	
	1,200	800	500	300	N OTP	
	400	400	400	300	n	
	800	800	800	600	×	Toshiba
	800	225	200	125	വ	Texas Instrument
	15	ហ	S	S	a	Signetics
	10	10	136	0	¥	SGS
	10	10	UI	0	a	Seiko-Epson
	40	40	70	70	G	SEEQ
	υ'n	υī	0	0	a	Ricoh
	30	0	Ø	N/A	×	Oki Electric
	800	1,140	1,220	1,620	a	
	500	990	1,250	1,230	z	NEC
	300	250	100	25	a	National Semi.
	0	0	0	0	C OTP	
	3,435	1,435	1,480	1,249	N OTP	
	157	19	0	0	a	
	935	1,776	2,096	1,637	N	Mitsubishi
	300	280	250	200	N OTP	
	550	450	175	150	C	
15,500	4,000	4,200	4,000	3,300	z	Intel
	0	0	0	0	C OIP	
	800	650	500	350	c	
	1,500	1,350	1,100	950	×	Hitachi
	200	10	85	35	c orp	
	500	493	317	112	G	
	500	545	600	908	×	General Instrument
	400	250	250	200	G	
	600	500	500	500	z	Fujitsu
	0	٥	o	0	a	
	0	0	0	0	z	Atme1
	1,000	1,050	1,000	700	z	AMD
	Otr.	Otr.	051.	Otr.	Process	Company
	4th	3rd	2nd	lst	SOW .	

Table 6 (Continued)
256K MOS EPROM Shipment Data, 1983-1987

			1986		
	lst	2nd	3rd	4th	
	Otr.	Otr.	Otr.	Otr.	<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	-	
	lst	2nđ	3rd	4th	
	Otr.	Otr.	Otr.	Otr.	<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	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.

Table 6 (Continued)

256K MOS EPROM Shipment Data, 1983-1987

	Total		norecord	WiferEarly				Toshiba	Texas Instrument	Signetics	SGS-Thomson	Seiko-Epson	SEEQ	Ricoh		Oki Electric		NEC	National Semi.			•	Mitsubishi			Microchip Tech., Inc.				Intel			Hitachi		Fujitsu		AMD	Company	1	
		G	¤ C	. .	c orr	ALO N	a	M	a	a	z	a	a	ი	N OTP	×	n	z	ဂ	C OTP	N OTP	a	×	T TO	Ω	z	C OTP	N OTP	a	X ·	G OTP	ი	×	G	z	n	z	Process	SOW	
	26,799	9,034	17,765	25	200	1,400	500	800	1,300	200	840	20	75	υn	800	100	1,090	690	654	0	950	400	1,300	200	900	600	100	800	450	4,500	0	2,200	2,500	700	900	0	1,585	Otr.	1st	
	30,687	11,087	19,600	30	400	1,500	800	800	1,400	250	1,160	20	75	(J)	800	100	870	540	1,257	0	450	500	1,800	200	1,000	700	50	1,200	500	5,400	0	2,000	2,500	1,700	800	10	1,850	Otr.	2nd	
	31,381	13,801	17,580	30	400	1,000	1,200	1,000	1,500	400	1,170	20	75	10	800	100	1,600	360	1,606	20	800	750	2,200	400	1,000	700	250	1,000	370	4,300	0	2,000	1,600	2,050	950	100	1,600	Otr.	3rđ	1987
(<u>c</u>	29,560	12,950	16,610	50	400	1,000	1,000	1,500	1,700	500	1,600	10	75	20	800	50	1,250	400	3,510	60	400	800	1,750	100	300	800	170	950	260	4,600	o (0	0	2,500	900	215	1,860	Otr.	4th	
(Continued)	118,427	46,872	71,555	135	1,400	4,900	3,500	4,100	5,900	1,350	4,770	70	300	40	3,200	350	4,810	1,990	7,027	80	2,600	2,450	7,050	900	3,200	2,800	570	3,950	1.580	18,800	,	6,200	6,600	6,950	3,550	325	6,895	Year		

Table 6 (Continued)
256K MOS EPROM Shipment Data, 1983-1987

			1987		
	lst	2nđ	3rd	4th	
	Otr.	Otr.	Otr.	Otr.	<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		
	lst	2nd	3rd	4th	
	Otr.	Otr.	Otr.	Otr.	Year
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	<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

Table 7
512K MOS EPROM Shipment Data, 1984-1987

				1984		
	MOS	lst	2nd	3rd	4th	
Company	Process	Ots.	Otr.	Otr.	Otr.	<u>Year</u>
AMD	N	s	2	2	4	8
Pujitsu	N	N/A	N/A	N/A	N/A	0
General Instrument	С	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	C
Intel	N	N/A	s	2	6	8
Mitsubishi	Ŋ	N/A	N/A	N/A	N/A	0
Toshiba	N	N/A	N/A	N/A	N/A	Q
	c	N/A	N/A	N/A	N/A	0
VLSI Technology	C	N/A	N/A	N/A	N/A	0
NaferScale	С	<u>N/A</u>	<u>N/A</u>	N/A	<u>N/A</u>	0
	М	0	2	4	10	16
	, c	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		2230.00	0	0	493.00	4100.13
Overall		\$250.00	\$150.00	\$120.00	\$95.00	\$108.13
Revenue (\$M)		*	0.3	0.5	1.0	1.7
				1984		
		lst	2nd	359	4th	
		Otr.	Otr.	Otr.	Otr.	Year
Market Share						
U.S.		0	100.04	100.0%	100.0%	100.04
Japan		0	0	0	0	0
Europe		0	0	0	0	0
Total		a	100.0%	100.0%	100.0%	100.0%
S = Sampling						

S = Sampling N/A = Not Available

Table 7 (Continued)
512K MOS EPROM Shipment Data, 1984-1987

				1985		
	MQS	lst	2nd	3rd	4th	
Company	Process	Otr.	Otr.	Otr.	Otr.	Year
AMD	n	12	30	35	75	152
Pujitau	H	N/A	N/A	S	10	10
General Instrument	C	N/A	N/A	A/K	N/A	O O
Ritachi	H	N/A	N/A	s	15	15
	¢	n/A	n/A	N/A	n/A	٥
Intel	H	15	50	65	135	265
Mitsubishi	N	N/A	n/a	H/A	N/A	0
Toshiba	N	N/A	N/A	N/A	5	0
	C	n/A	N/A	N/A	N/A	0
VLSI Technology	¢	N/A	N/A	N/A	N/A	0
WaferScale	Ç	<u>n/a</u>	N/A	<u>N/A</u>	<u>N/A</u>	
	N	27	80	100	225	432
	С	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 (SM)		2.2	4.0	3.0	5.2	14.4
				1985		
		lst	2nd	3rd	4th	
		Otr.	Otr.	Otr.	Otr.	<u>Year</u>
Market Share						
U.S.		100.0%	100.0%	100.04	89.4%	94.3
Japan		0	0	0	10.6	5.7
Burope		0	0	0	0	0
Total		100.0%	100.0%	100.0%	100.0	100.04

S = Sampling N/A = Not Available

Table 7 (Continued)
512K MOS EPROM Shipment Data, 1984–1987

				1986		
	MOS	let	2nd	314	4th	
Company	Process	Qtr.	Otr.	Otr.	Otr.	Year
AMD	N	175	280	540	400	1,395
Fujitsu	c	25	25	25	25	100
General Instrument	С	s	10	25	100	135
	OTP	N/A	N/A	S	5	5
Eitachi	N	N/A	ş	60	300	360
	c	N/A	N/A	N/A	N/A	0
Intel	n	250	400	730	900	2,280
Mitaubishi	N	N/A	S	58	365	423
National Semi.	С	N/A	s	0	0	0
Oki Electric	19	N/A	N/A	s	S	0
Texas Instruments	C	H/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	<u>\$</u>	5	5	5	15
	N	475	830	1,688	2,395	5,388
	c	25	40	58	<u>190</u>	313
Total		500	870	1,746	2,585	5,701
Percentage Change from						
Previous Quarter		113%	74%	1010	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 (\$H)		7.1	10.6	21.1	28.8	67.6
				1986		
		lst	2nd	3rd	4th	
		Otr.	Otr.	Otr.	Otr.	Year
Market Share						
U.S.		85.0%	79.9%	74.6%	56.79	68.2%
Japan		15.0	20.1	25.4	43.3	31.8
Europe		0	0			0
Total		100.01	100.04	100.0%	100.0%	100.0%

S = Sampling N/A = Not Available

(Continued)

3

MOS EPROM—Data

Table 7 (Continued)
512K MOS EPROM Shipment Data, 1984–1987

				1987		
	MOS	lst	2nd	3rd	4th	
Company	Process	Otr.	Otr.	Otr.	Otr.	Year
AMD	N	740	785	525	605	2,655
	С	s	5	25	285	315
Pujitsu	С	500	1,500	1,800	2,100	5,900
Hitachi	N	750	800	850	950	3,350
Intel	C N	8 800	0 1,200	0 1,800	0 2,700	6,500
Microchip Tech., Inc.	č	100	150	100	120	470
	OTP	10	10	20	20	60
Mitsubishi	N	750	800	1,200	1,450	4,200
National Semi.	Ċ	0	0	0	0	0
NBC	C	N/A	s	0	1,050	1,050
Oki Electric	N	· a	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	Ç	5	5	5	8	23
WaferScale	c	<u>°</u>	0	0	0	0
	19	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%	534	
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 (SM)		45.8	59.7	63.9	84.8	254.2
				1987		
		lst	2nd	3rd	4th	
		Otr.	Otr.	Otr.	Otr.	Year
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

Table 8
1-Mbit MOS EPROM Shipment Data, 1986-1987

					1986		
_	MOS	Technology	lst	2nd	310	4th	
<u>Company</u>	Process	<u> Peatures</u>	Otr.	Otr.	<u>Qtr.</u>	Otr.	<u>Year</u>
AMD	С,	x16	1	. 1	. 4	6	12
Atmel	С	N/A	0	-		-	
Pujitsu	С	x8, x16	N/A	_	_	. 1	_
General Instrument	c	x16	N/A				_
Bitachi	C	x8, x16	\$				
Intel	N	x8, x16	S				
Motorola	C	N/A	8	_	_	-	-
National Semi. NBC	c c	x8, x16	N/A				
Oki Electric	Ċ	xl6 xl6	n/a n/a		-	_	_
Texas Instruments	Č	N/A	N/A			_	_
Toshiba	Č	x8	N/A	•		-	-
Other	č	N/A	N/A	_	_		
	-	•4,				<u> </u>	_
	N		0	5			60
	С		1	<u> 11</u>	39	<u>98</u>	<u>149</u>
Total			1	16	64	128	209
Percentage Change fro Previous Quarter Cumulative Total	m.		0	3,100%	300 % 81	100 1 209	
ASPs: NMOS			\$110.00	*** **	\$50 00	842.00	*40 50
CMOS			\$150.00				
Overall			\$150.00				
Revenue (SM)			0.1	1.2	3.8	7.1	12.2
					1986		
			lat	2nd	3rd	4th	
			Otr.	Otr.	Otr.	Otr.	Year
Market Share							
U.S.			100.0%	37.5%	45.3%	28.14	34.3%
Japan			0	62.5	54.7	71.9	65.7
Europe				0		0	0
Total			100.0%	100.0%	100.0%	100.0%	100.0%
S = Sampling N/A = Not Available							

Table 8 (Continued)

1-Mbit MOS EPROM Shipment Data, 1986-1987

					1987		
	MQS	Technology	let	2nd	3cd	4th	
Company	Process	<u>Peatures</u>	Otr.	Otr.	Otr.	Otr.	Year
AND	c	x16	5	5	5	15	30
Pujitsu	c	x8, x16	N/A	\$	5	10	15
Ritachi	С	x8, x16	100	70	150	250	570
Intel	М	x8, x16	50	30	80	150	310
Microchip Tech.,	_						_
inc.	c		H/A	H/A	N/A	N/A	. 0
Mitsubishi	Ç	x8, x16	0	5	5	80	90
National Semi.	C	x8, x16 x8	0	0	0	0	0
NEC	Ċ	x16	H/A	0	50 50	300	350
Oki Electric	Ċ		N/A			100 S	150
SGS-homson	ç	x8, x16	N/A N/A	N/A N/A	H/A H/A	N/A	0
Texas Instruments	č		0	n/a D	0	N/A	0
Toshba	č	x8, x16	20	40	40	_50	150
	N		50	30	80	150	310
	¢		125	<u>120</u>	305	805	1,355
Total			175	150	385	955	1,655
Percentage Change	from						
Previous Quarter			370	(14%)	1574	148%	
Cumulative Total			384	534	919	1,874	-
ASPs: NMOS			\$26.00	\$24.00	\$24.00	\$24.00	\$24.32
2906			\$40.00	\$32.00	\$26.00	\$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		
			lst	2nd	3rd	4th	
			<u>Qtr.</u>	Otr.	Otr.	Otr.	Year
Market Share							
u.s.			31.40	23.34	22.1%	17.3%	20.4%
Japan			68.6	76.7	77.9	82.7	79.6
Europe				 0	0	<u>_</u>	 °
Total			100.0%	100.00	100.0%	100.0%	100.0%
S = Sampling N/A = Not Availabl	•						

Source: Dataquest

May 1989

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.

Table 1

8K MOS EPROM Shipment Data, 1976–1985

	lst	2nd	3rd	4th				
Company	Otr.	Otr.	Otr.	<u>0tr.</u>	<u>Year</u>			
AMD								
Electronic Arrays	N/A	N/A	A/N	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>	_20	<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			
			1976					
	lst	2nd	3rd	4th	· 			
	Otr.	Otr.	Otr.	Otr.	<u>Year</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

Table 1 (Continued)

8K MOS EPROM Shipment Data, 1976–1985

	1977								
	lst	2nd	3rd	4th					
Company	Otr.	Otr.	Otr.	Otr.	<u>Year</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	100	100	· <u>200</u>	<u>300</u>	700				
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				
			1977						
	lst	2nd	3rd	4th					
	Otr.	Otr.	Otr.	Otr.	<u>Year</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	0	0	0	0	0				
Total	100.0%	100.0%	100.0%	100.0%	100.0%				

N/A = Not Available S = Sampling

Table 1 (Continued)

8K MOS EPROM Shipment Data, 1976–1985

	1978							
	lst	2nd	3rd	4th				
Company	Otr.	Otr.	Otr.	Otr.	<u>Year</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	N/A	<u> </u>	10	30	40			
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			
			1978					
	lst	2nd	3rd	4th				
	Otr.	Otr.	Otr.	Otr.	<u>Year</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	0	0	0	0	0			
Total	100.0%	100.0%	100.0%	100.0%	100.0%			

N/A = Not Available

Table 1 (Continued)

8K MOS EPROM Shipment Data, 1976-1985

	1979							
	lst	2nd	3rd	4th				
Company	Otr.	Otr.	Otr.	Otr.	<u>Year</u>			
ÀМD	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			
			197 <u>9</u>					
	lst	2nd	3rd	4th				
	Otr.	Otr.	Otr.	Otr.	<u>Year</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

Table 1 (Continued)

8K MOS EPROM Shipment Data, 1976–1985

	lst	2nd	3rd	4th				
Company	Otr.	Otr.	Otr.	Otr.	<u>Year</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	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					
	lst	2nd	3rd	4th				
	Otr.	Otr.	Otr.	Otr.	<u>Year</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	0	0	0	0	0			
Total	100.0%	100.0%	100.0%	100.0%	100.0%			

N/A = Not Available

S = Sampling

Table 1 (Continued)

8K MOS EPROM Shipment Data, 1976-1985

	1981						
	lst	2nd	3rd	4th			
Company	Otr.	Otr.	Otr.	Otr.	<u>Year</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	0	0	0	0	0		
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		
			1981				
	lst	2nd	3rd	4th			
	Otr.	Otr.	Otr.	Otr.	<u>Year</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	0	0	0	0	0		
Total	100.0%	100.0%	100.0%	100.0%	100.0%		

Table 1 (Continued)

8K MOS EPROM Shipment Data, 1976–1985

	1982							
	1st	2nd	3rd	4th				
Company	Otr.	Otr.	Otr.	Otr.	<u>Year</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	0	0	· <u> </u>	0	0			
Total	645	430	480	300	1,855			
Percentage Change from Previous Quarter	(27%)	(33%)	12%	(38%)				
LIANIONS ANGICET	(2/4)	(334)	12.4	(304)				
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			
			1982					
	lst	2nd	3rd	4th				
	Otr.	Otr.	Otr.	Otr.	Year			
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	0	0	0	0	0			
Total	100.0%	100.0%	100.0%	100.0%	100.0%			

Table 1 (Continued)

8K MOS EPROM Shipment Data, 1976–1985

	1983						
	1st	2nd	3rd	4th			
Company	Otr.	Otr.	Otr.	Otr.	<u>Year</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	0	0	0	0	0		
Total	270	250	145	75	740		
Percentage Change from		45-3	4	()			
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		
			1983	_			
	lst	2nd	3rd	4th			
	Otr.	Otr.	Otr.	Otr.	<u>Year</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%		

Table 1 (Continued)

8K MOS EPROM Shipment Data, 1976–1985

	lst	2nd	3rd	4th			
Company	Otr.	Otr.	Otr.	Otr.	<u>Year</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	0	0	0	0	0		
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		
	•	_	1984				
	lst	2nd	3rd	4th			
	Otr.	Otr.	Otr.	Otr.	Year		
Market Share							
v.s.	100.0%	100.0%	100.0%	100.0%	100.0%		
Japan	Q	0	0	0	0		
Europe	0	0	0	0	0		
Total	100.0%	100.0%	100.0%	100.0%	100.0%		

Table 1 (Continued)

8K MOS EPROM Shipment Data, 1976–1985

	1985							
	lst	2nd	3rd	4th				
Company	Otr.	Otr.	Otr.	Otr.	<u>Year</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	Ģ	. 0	0			
Oki Electric	0	0	0	0	0			
Texas Instruments	0	0	. 0	0	0			
Toshiba	<u> </u>	0	0	<u> </u>	0			
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			
			1985					
	lst	2nd	3rd	4th				
	Otr.	Otr.	Otr.	Otr.	<u>Year</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%			

Source: Dataquest

April 1988

Table 2

16K MOS EPROM Shipment Data, 1976-1987

AMD . N Burotechnique C Fairchild N Fujitsu N Hitachi N Intel N Matgushita M Mitsubishi N Mostek N Motorola N National Semi.	ress	1st Qtc. N/A N/A N/A N/A N/A N/A N/A	2nd Qtr. H/A H/A H/A H/A H/A H/A H/A	3rd Qtr- N/A N/A N/A N/A S N/A N/A	4th Qts. N/A N/A H/A N/A 10 H/A N/A	Year N/A N/A N/A N/A 10 N/A
AMD . N. Burotechnique C. Pairchild . N. Fujitsu . N. Hitachi . N. Hit		N/A N/A N/A N/A N/A N/A N/A N/A	H/A H/A H/A H/A H/A H/A H/A	N/A N/A N/A N/A N/A S N/A	N/A N/A H/A H/A N/A 10 H/A	N/A N/A N/A N/A TN/A
Burotechnique Pairchild Fujitsu Hitachi Intel Matsushita Mitsubishi Mostek Motorola National Semi.		H/A H/A H/A H/A H/A H/A H/A	H/A H/A H/A H/A H/A H/A H/A	N/A N/A N/A N/A S N/A N/A	N/A N/A N/A N/A 10 N/A	H/A H/A H/A 10
Eurotechnique Pairchild Fujitau Hitachi Intel Matsushita Mitsubishi Mostek Motorola National Semi.		N/A N/A N/A N/A N/A N/A N/A	H/A H/A H/A H/A H/A H/A	H/A H/A H/A S H/A H/A	H/A H/A N/A 10 H/A	N/A N/A N/A
Pairchild N Fujitsu X Hitachi N Intel N Matsushita M Mitsubishi N Mostek X Motorola N National Semi.		H/A H/A H/A H/A H/A H/A	H/A H/A H/A H/A H/A	N/A N/A S N/A N/A	H/A N/A 10 N/A	N/A N/A 10
Fujitsu Mitachi Mitachi Mitachi Mitachi Mitachi Mitachita Mitachita Mitachishi Mostek Mitachia		H/A H/A H/A H/A H/A	N/A N/A N/A N/A	H/A S H/A N/A	N/A 10 N/A	*N/A 10
Hitachi N Intel N Matsushita M Misubishi N Mostek N Motorola N National Semi.		H/A H/A H/A H/A	H/A H/A N/A H/A	S N/A N/A	10 N/A	10
Intel Matsushita Mitsubishi Mostek Motorola Mational Semi.		N/A N/A N/A N/A	N/A N/A H/A	N/A N/A	N/A	
Matsushita M Mitsubishi N Mostek N Motorola N National Semi.		N/A N/A N/A	N/A N/A	N/A		N/A
Mitsubishi N Nostek N Motorola N National Semi.		N/A N/A	H/A		N/A	
Motorola N National Semi. N	!	N/A		N/A		N/A
National Semi. N	:		N/A		N/A	N/A
c	:	N/A		N/A	N/A	N/A
			N/A	N/A	N/A	N/A
		N/A	N/A	N/A	N/A	N/A
NBC N		H/A	N/A	N/A	N/A	N/A
Oki Electric N		H/A	N/A	N/A	N/A	H/A
SGS-Ates N	•	N/A	N/A	N/A	H/A	N/A
Synertek N	•	N/A	N/A	N/A	N/A	N/A
Texas Instruments N	1	N/A	N/A	N/A	5	5
Toshiba N	•	N/A	N/A	<u>H/A</u>	<u>N/A</u>	<u>n/a</u>
н	ı	0	0	0	15	15
c	:	0	0	0	<u> </u>	
Total		0	0	0	15	15
Percentage Change from Previous Quarter						
Cumulative Total		0	0		15	
ASPs: NMOS		\$50.00	\$50.00	\$50.00	\$50.00	\$50.00
CMOS		*30.00	\$30.00	******	450.00	930.00
Overall		\$50.00	\$50.00	\$50.00	\$50.00	\$50.00
Revenue (\$H)		0	0	0	0.8	0.8
				1976		
		lst	2nd	Jtd	4th	
		Otr.	Otr.	Otr.	Qtr.	Year
Market Share						
u.s.		0	0	0	100.00	100.0%
Japan		0	0	0	0	0
Europe		_0	_0	_0	0	0
Total		0	0	0	100.04	100.01

S = Sampling N/A = Not Available

Table 2 (Continued)

16K MOS EPROM Shipment Data, 1976-1987

<u>Company</u>	MOS Process	lst	2nd	1977 3rđ	4th	
Company	Process					
		Qtr.	Qtr.	Otr.	Otr.	Year
AMD	N	N/A	N/A	N/A	N/A	N/A
Eurotechnique	c	N/A	N/A	N/A	H/A	N/A
Fairchild	N	N/A	H/A	H/A	N/A	N/A
Pujitsu	Ŋ	N/A	N/A	N/A	H/A	N/A
Hitachi	N	N/A	N/A	N/A	N/A	N/A
Intel	Я	40	75	100	125	340
Matsushita	N	N/A	H/A	H/A	H/A	N/A
Mitsubishi	N	N/A	N/A	N/A	N/A	N/A
Mostek	N	H/A	N/A	N/A	N/A	N/A
Motorola	n	N/A	N/A	N/A	N/A	N/A
National Semi.	И	N/A	N/A	N/A	H/A	N/A
	c	H/A	N/A	N/A	N/A	N/A
NEC	N	H/A	N/A	N/A	N/A	N/A
Oki Electric	N	H/A	H/A	H/A	N/A	N/A
SGS-Ates	M	N/A	N/A	N/A.	N/A	N/A
Synectek	N	N/A	N/A	N/A	N/A	H/A
Texas Instruments	N	20	25	30	55	130
Toshiba	N	N/A	N/A	H/A	N/A	N/A
	N	60	100	130	180	470
	C	0	0	0	0	0
Total		6●	100	130	180	470
Percentage Change from						
Previous Quarter		0	670	309	384	
Cumulative Total		75	175	305	485	
ASPs: NMOS		\$45.00 0	\$45.00	\$30.00	\$30.00	\$35.11
Overall		\$45.00	\$45.00	#30.00	\$30.00	\$35.11
Revenue (\$M)		2.7	4.5	3.9	5.4	16.5
				1977		
		lst	2nd	3rd	4th	
		Otr.	Qtr.	Qtr.	Otr.	Year,
Market Share						
u.s.		100.00	100.0%	100.04	100.0%	100.00
Japan		0	0	0	0	0
Europe			0	0	0	0
Total		100.04	100.0%	100.04	100.01	100.01

N/A - Not Available

MOS EPROM—Data

Table 2 (Continued)

16K MOS EPROM Shipment Data, 1976–1987

CMOS 0 0 0 0	<u>Year</u>
AMD Eurotechnique C N/A N/A N/A N/A N/A N/A Pairchild N N/A N/A N/A N/A N/A N/A N/A N/A N/A N	<u>Year</u>
Eurotechnique C N/A N/A N/A N/A N/A Fairchild N N/A N/A N/A N/A N/A N/A N/A Foiltsu N N/A N/A N/A N/A 5 NH N/A N/A N/A N/A 5 NH N/A	
Fairchild N N/A N/A N/A N/A N/A N/A N/A N/A N/A S A N/A N/A S <t< td=""><td>0</td></t<>	0
Pujitsu N N/A N/A 5 30 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	0
Pujitsu N N/A N/A 5 300 Ritachi N N/A N/A 5 300 Intel N 250 400 250 450 Matsushita N N/A N/A N/A N/A N/A N/A Mitsubishi N N/A N/A N/A N/A N/A Mostek N S S 5 25 Motorola N N/A S 10 90 National Semi. N N/A N/A N/A N/A N/A NEC N/A N/A N/A N/A N/A NEC N N/A N/A N/A N/A N/A NEC N N/A N/A N/A N/A N/A SGS-Atem N N/A N/A N/A N/A Synertek N N/A N/A N/A N/A Synertek N N/A N/A N/A N/A Texas Instruments N 100 250 200 300 Toshiba N N/A N/A N/A N/A N/A Toshiba N N/A N/A N/A N/A N/A Toshiba N N/A N/A N/A N/A N/A Percentage Change from Previous Quarter 940 862 (280) 952 Cumulative Total 835 1,485 1,950 2,855 ASPs: NNOS \$28.00 \$25.00 \$25.00 \$15.00 \$	0
### ### ### ### ### ### ### ### ### ##	5
Intel N 250 400 250 450 Mataushits N M/A	35
Mitsubishi N N/A N/A N/A N/A Mostek H S S S 25 Motorola N N/A S 10 90 National Semi. N N/A N/A S 10 90 National Semi. N N/A N/A N/A N/A N/A N/A NEC N N/A N/A N/A N/A N/A N/A Oki Electric N N/A N/A N/A N/A N/A N/A Oki Electric N N/A N/A N/A N/A N/A N/A SGS-Atex N N/A	1,350
Mitsubishi N N/A N/A N/A N/A Mostek N S S S 25 Motorola N N/A S 10 90 Mational Semi. N N/A N/A S 10 90 Mational Semi. N N/A	. 0
Motorola	0
National Semi. Nati	25
NEC	100
NEC	0
Oki Electric N N/A N/A N/A N/A N/A N/A N/A SGS-Atem N N/A <	Ó
SGS-Atex	. 0
Synertek N N/A N/A N/A N/A N/A N/A Texas Instruments N 100 250 200 300 Toshiba N N/A N/A N/A 3 5 N 350 650 465 905 C 0 0 0 0 0 0 Total 350 650 465 905 Total 350 650 465 905 Complete Previous Quarter 94% 86% (28%) 95% Cumulative Total 835 1,485 1,950 2,855 ASPs: NNOS \$28.00 \$25.00 \$25.00 \$15.00 \$500 \$500 \$500 \$500 \$500 \$500 \$500	Q.
Texas Instruments N 100 250 200 300 Toshiba N N/A N/A 3 5 N 350 650 465 905 C 0 0 0 0 0 Total Percentage Change from Previous Quarter 94% 86% (28%) 95% Cumulative Total 835 1,485 1,950 2,855 ASPs: Neos 528.00 \$25.00 \$25.00 \$15.00 \$ CMOS 0 0 0 0	0
Toshiba N N/A N/A 3 5 N 350 650 465 905 C 0 0 0 0 0 Total 350 650 465 905 Percentage Change from Previous Quarter 94% 86% (28%) 95% Cumulative Total 835 1,485 1,950 2,855 ASPs: NewOS \$28.00 \$25.00 \$25.00 \$15.00 \$ CMOS 0 0 0 0	Q.
N 350 650 465 905 C 0 0 0 0 0 Total 350 650 465 905 Percentage Change from Previous Quarter 94% 86% (28%) 95% Cumulative Total 835 1,485 1,950 2,855 ASPs: NewOS \$28.00 \$25.00 \$25.00 \$15.00 \$ CMOS 0 0 0 0	850
C 0 0 0 0 0 Total 350 650 465 905 Percentage Change from Previous Quarter 94% 86% (28%) 95% Cumulative Total 835 1,485 1,950 2,855 ASPs: NeOS \$28.00 \$25.00 \$25.00 \$15.00 \$ CMOS 0 0 0 0	5
Total 350 650 465 905 Percentage Change from Previous Quarter 94% 86% (28%) 95% Cumulative Total 835 1,485 1,950 2,855 ASPs: NeOS \$28.00 \$25.00 \$25.00 \$15.00 \$ CMOS 0 0 0 0	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 \$ CMOS 0 0 0 0	0
Previous Quarter 94% 86% (28%) 95% Cumulative Total 835 1,485 1,950 2,855 ASPs: NewOS \$28.00 \$25.00 \$25.00 \$15.00 \$ CMOS 0 0 0 0	2,370
Cumulative Total 835 1,485 1,950 2,855 ASPs: NNOS \$28.00 \$25.00 \$25.00 \$15.00 \$ CMOS 0 0 0 0	
ASPs: NNOS \$28.00 \$25.00 \$25.00 \$15.00 \$ CMOS 0 0 0	
CMOS 0 0 0 0	
	21.62
Overall \$28.00 \$25.00 \$25.00 \$15.00 \$	0
	21.62
Revenue (\$M) 9.8 16.3 11.6 13.6	51.3
1978	
Let 2nd 3rd 4th	
Otr. Otr. Otr.	Year
Market Share	
U.S. 100.0% 100.0% 98.9% 95.6%	98.11
Japan 0 0 1.1 4.4	1.9
Europe 0 0 0 0	0
Total 100.0% 100.0% 100.0% 100.0% 1	00.04

S = Sampling N/A = Not Available

MOS EPROM—Data

Table 2 (Continued)

16K MOS EPROM Shipment Data, 1976–1987

				1979		
	MOS	Let	2nd	3cd	4th	
<u>Company</u>	Process	Otr.	Qtr.	Otr.	Otr.	Year
AMD	N	N/A	ş	5	10	15
Eurotechnique	С	N/A	N/A	N/A	N/A	0
Fairchild	N	N/A	N/A	N/A	N/A	0
Fujitou	N	70	200	300	300	870
Hitachi	N	125	200	350	500	1,175
Intel	N	550	750	600	900	3,000
Matsushita	N	H/A	N/A	H/A	N/A	0
Mitsubishi	N	10	20	50	90	170
Mostek	N	90	150	250	350	840
Motorola	*	160	150	160	200	670
National Semi.	N	5	50	80	120	255
	С	N/A	N/A	N/A	N/A	0
MEC	H	N/A	N/A	H/A	5	5
Oki Electric	N	N/A	N/A	N/A	N/A	0
SGS-Ates	N	N/A	N/A	N/A	H/A	0
Symertek.	N	N/A	N/A	N/A	S	0
Texas Instruments	н	400	900	1,100	1,800	4,200
Toshibe	N	25	50	90	200	<u> 365</u>
	N	1,435	2,470	3,185	4.475	11.565
	č					0
Total		1,435	2,470	3,185	4,475	11,565
Percentage Change from		584	***			•
Previous Quarter		594	729	290	418	
Cumulative Total		4,290	6,760	9,945	14,420	
ASPs: NMOS CNO6	.	\$17.00 0	\$22.00	\$19.00 0	\$17.00 0	\$18.62 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		
		let	2nd	3rd	4th	
		Otr.	Otr.	Qtr.	Otr.	Year
Market Share						
U.\$.		84.09	81.01	75.24	75.5%	77.60
Japan		16.0	L9.0	24.8	24.5	22.4
Europe		0	0	0	0	0
Total		100.04	100.04	100.0%	100.01	100.04

S = Sampling N/A = Not Available

Table 2 (Continued)

16K MOS EPROM Shipment Data, 1976–1987

				1980		
	HOS	lst	2nd	3rd	4th	
Company	Process	Otr.	Otr.	Qtr.	Otr.	Year
AMD	N	25	50	100	175	350
Eurotechnique	Ç	H/A	N/A	N/A	H/A	0
Fairchild	N	30	30 0	300	250	800
Fujitsu	И	350	750	700	650	2,450
Hitachi	**	700	850	1,025	1,325	3,900
Intel	N	950	1,000	1,700	1,850	5,500
Matsushite	N	S	50	50	80	180
Mítsubishi	И	210	260	270	410	1,150
Mostek	n	275	250	350	450	1,325
Motorola	И	250	350	500	500	1,600
National Semi.	N	250	250	300	425	1,225
	c	N/A	N/A	H/A	N/A	0
NEC	, N	10	25	50	125	210
Oki Electric	N	s	0	0	0	Đ
SGS-Ates	N	1,800	0	0	5	1,805
Synertek	N	200	25	10	Û	235
Texas Instruments	H	2,000	2,000	2,000	2,100	8,100
Toshibe	N	300	330	350	400	1,380
	N	7,350	6,490	7,705	8,745	30,290
	¢	0	0	0	0	0
Total		7, 350	6,490	7,705	8,745	30, 290
Percentage Change from Previous Quarter		644	(12%)	199	139	
Liasioda Somicat		0.54	(124)	134	134	
Cumulative Total		21.770	28,260	35,965	44,710	
ASPa: NMOS CMOS		\$15.00	\$11.00	\$8.00 0	\$6.00 0	\$9.76 0
Overall		\$15.00	\$11.00	\$8.00	\$6.00	\$9.76
Revenue (\$M)		110.3	71.4	61.6	52.5	295.8
				1980		
		lst	2nd	Jed	4th	
		Otr.	Otc.	Otr.	Otr.	Year
Market Share						
U.S.		54.19	65.18	68.39	65.84	63.4%
Japan		21.4	34.9	31.7	34.2	30.6
Europe		24.5	9	. 0	0.1	
-						6.0
Total		100.00	100.0%	100.04	100.00	100.00

S * Sampling N/A * Not Available

Table 2 (Continued)

16K MOS EPROM Shipment Data, 1976–1987

				1981		
	MOS	let	2nd	3rd	4th	
Company	Process	Otr.	Otr.	Qtr.	Otr.	Year
AMD	N	250	350	485	750	1,835
Eurotechnique	c	H/A	N/A	s	15	15
Pairchild	N	100	20	20	0	140
Pojitsu	H	750	1,000	700	500	2,950
Hitachi	P)	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
	С	N/A	N/A	N/A	H/A	H/A
NBC	N	175	250	600	900	1,925
Oki Blectric	N	25	40	80	100	245
SGS-Ates	N	15	25	50	75	165
Synertek	N	0	0	0	0	0
Texas Instruments	₩	2,200	2,500	2,200	2,200	9,100
Toshiba	N	90	100	200	350	740
	M	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						šč.
Previous Quarter	•	179	129	(14)	36	
Cumulative Total		54,915	66,360	77,665	89,325	
ASPs: NNOS CMOS		\$4.50	#3.50	\$3.00	\$2.50	\$3.34
Ovecall		9 \$4.50	\$3.50	93.00	0 \$2.50	\$3.34
Revenue (\$M)		45.9	40.1	33.9	29.1	149.0
				1981		
		lst	2nd	3rd	4th	
		Qte.	Qtr.	Qte.	Qtr.	Year
Market Share						
u.s.		66.1%	65.0%	67.30	70.8%	67.30
Japan		33.7	34.8	32.3	28.5	32.3
Europe		0.1	0.2	0.4	0.8	0.4
Total		100.04	100.04	100.01	100.04	100.09

S = Sampling N/A = Mot Available

Table 2 (Continued)

16K MOS EPROM Shipment Data, 1976–1987

				1982		
	MOS	lst	2nd	Jrd	4th	
Company	Process	Otr.	Otr.	Otr.	Otr.	<u>Year</u>
AMD	H	1,000	1,150	1,150	900	4,200
Eurotechnique	¢	100	400	500	600	1,600
Pairchild	н	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	и	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.	. #	1.200	1,250	1.300	2,200	5.950
	· c	50	150	200	200	600
NBC	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 N	0	0	0	3_0	0
Texas Instruments		2.000	2,000	1.800	1,800	7,600
Toshiba	N	500	400	300	300	1,500
						<u></u>
	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		(29)	(4%)	(78)	(14)	
-						
Cumulative Total		100,725	111,715	121,965	132,155	
ASPs: NMOS CMOS		\$3.25 0	\$ 3.10	\$3.00 0	\$3.00 0	\$3.09
Overall		\$3.25	\$ 3.10	\$3.00	\$3.00	\$3.09
Revenue (\$M)		36.6	32.4	28.7	20.2	125.7
				1962		
		let	2nd)rd	4th	
		otr.	Otr.	Otr.	Qtr.	Year
Market Share						
u.s.		70.21	67.48	64.48	64.9%	66.81
Japan		28.1	27.3	27.3	24.1	26.8
Europe		1.8	5.3	8.3	11.0	6.4
Total		100.04	100.01			
		100.04	100.04	100.01	100.04	100.00

Table 2 (Continued)

16K MOS EPROM Shipment Data, 1976-1987

				1963		
	MOS	lat	2nd	3ed	4th	
Company	Process	Otr.	Otr.	Qtr.	Otr.	Year
AMD	N	700	700	1,000	1,200	3,600
Burotechnique	c	200	200	200	200	800
Fairchild	N	0	0	0	0	0
Pujitsu	N	50	50	0	Ů	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
Mitaubishi	H	180	120	160	130	590
Mostek	Н	200	150	150	50	550
Motorola	N	50	90	30	0	160
National Semi.	N	2,150	2,500	2,500	2,800	9,950
	c	350	\$00	500	700	2,050
NEC	N	2,000	2,500	2,700	1,500	0,700
Oki Blectric	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	H	<u> 200</u>	100	100	100	500
•	N	9,630	11,100	11,740	10,830	43,300
	¢	550	700	700	900	2,850
Total		10,180	11,800	12,440	11,730	46,150
Percentage Change from						•
Previous Quarter		04	160	50	(6%)	
Cumulative Total		142,335	154,135	166,575	178,305	
ASPS: NRIOS CNOS		\$3.00	\$3.15 0	#3.25 0	\$3.35 0	\$3.19 0
Overall		\$3.00	93.15	\$3.25	\$3.35	\$3.19
Revenue (\$M)		28.9	35.0	30.2	36.3	138.3
				1963		
		let	2nd	3rd	4th	
		Otr.	Otr.	Qtr.	Otr.	Year
Harket Share						
u.s.		63.49	63.0%	64.19	72.0%	65,79
Japan		29.8	28.6	27.8	18.6	26.1
Europe		6.9	<u> 8.5</u>	8.0	9.4	<u> 9.2</u>
Total		100.04	100.01	100.04	100.0%	100.04

Table 2 (Continued)

16K MOS EPROM Shipment Data, 1976–1987

				1984		
	MOS	lst	2nd	3rd	4th	
Company	Process	Qtr.	Ote.	Qtr.	Otr.	Year
AMD	N	1,000	1,100	1,200	1,300	4,600
Paicchild	N	0	0	0	0	0
Pujitsu	N	0	0	Q	0	0
Hitachi	34	0	0	0	0	0
Intel	N	300	150	100	50	600
Matsushita	N	50	50	25	0	125
Mitsubisni	н	130	130	130	100	490
Mostek	N	0	0	0	0	0
Motorola	n	0	0	0	0	0
National Sami.	N	2,800	2,700	2,400	2,000	9,900
NEC	e -	700	700	550 050	400	2.350
	Ņ	1,350	1,200	950	700	4,200
Oki Electric	H	250	250	200	200	900
SGS	N	1,050	600	300	800	2,750
Synertek	N	0	0	0		
Texas Instrumenta	N	3,500	3,000	2,000	1,800	10,300
Thomson-Eurotechnique	¢	200	250	250	250	950
Toshiba	H		0	0	0	
•	N	10,430	9,180	7,305	6,950	33,865
	¢	900	950	800	<u>650</u>	3,300
Total		11,330	10,130	8,105	7,600	37,165
Percentage Change from						
Previous Quarter		(34)	(114)	(201)	(69)	
Cumulative Total		189,635	199,765	207,870	215,470	
ASPs: NMOS		\$3.35	\$3.35	\$3.00	\$2.85	\$3.17
CHOS		\$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		
		lat	2nd	3rd	4th	
		Qtr.	Qtr.	Otr.	Qtr.	Year
Market Share						
U.S.		73.30	75.54	77.10	73.0%	74.79
Japan		15.7	16.1	16.1	13.2	15.4
Europe		11.0	8.4			-
			0.4	6.8	13.8	10.0
Total		100.04	100.00	100.09	100.04	100.04

Table 2 (Continued)

16K MOS EPROM Shipment Data, 1976–1987

			73			
				1985		
	MOS	lst	2nd	3rd	4th	
Company	Process	Otr.	Otr.	Otr.	Qtr.	Year
AMO	N	1,550	1,850	1,350	1,050	5,800
Fairchild	N	0	0	0	0	0
Pujitsu	N	0	0	0	0	0
Hitachi	N	0	0	0	0	0
Intel	N	0	0	0	0	0
Matsushita	N	0	G.	0	0	0
Mitsubishi	N	50	50	0	0	100
Mostek	N	0	0	0	O	0
Motorola	N	0	0	0	G	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	H	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	¢	350	450	400	500	1,700
Toshiba	N	0	0	0	0	0
	H	6,200	6,200	6,450	5,420	24,270
	c	750	800	800	1,000	3,350
Total		6,950	7,0 00	7,250	6,420	27,620
Percentage Change from						
Previous Quarter		(9%)	14	46	(110)	••
Cumulative Total		222,420	229,420	236,670	243,090	
ASPs: NMOS		\$2.60	\$2.40	\$2.25	\$2.25	\$2.38
CNOS		\$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
				1985		
		lst	2nd	3rd	4th	
		Otr.	Qtr.	Otr.	Qtr.	Teas
Market Share						
U.S.		75.50	75.71	66.9%	67.80	71.50
Japan		8.6	6.4	12.4	5.6	0.4
Europe		_15.B	17.9	20.7	26.5	20.1
Total		100.00	100.04	100.0%	100.00	100.04

Table 2 (Continued)

16K MOS EPROM Shipment Data, 1976–1987

				1986		
	MOS	let	2nd	3£d	4th	
Company	Process	Ott.	Qtr.	Otr.	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	H	180	220	80	40	520
SG5	14	356	189	600	400	1,545
Texas Instruments	R	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%)	(134)	(25%)	
Cumulative Total		248,126	251,935	255,265	257,755	
ASPs: NMOS		\$2.35	\$2.40	\$2.40	\$2.50	\$2.40
CMOS		9	0	3	0	0
Overmil		\$2.35	\$2.40	\$2.40	\$2.50	\$2.40
Revenue (\$M)		11.8	9.1	6.0	6.2	35.2
				1986		
		lst	2nd	3ed	4th	
		Qtr.	Qtr.	Qtr.	Otr.	Teac
Market Share						
v.s.		69.5%	73.50	61.64	65.30	68.0%
Japan		3.6	5.8	2.4	1.6	3.5
Burope		26.9	20.7	36.0	33.1	20,4
Total		100.04	100.00	100.0%	100.04	100.04

Table 2 (Continued)

16K MOS EPROM Shipment Data, 1976–1987

j.				1987 _		
	MOS	lst	2nd	3rd	4th	
Company	Process	Qtr.	Qtr.	Otr.	Qtr.	Year
AMD	H	500	350	300	350	1,500
Cypress	c	150	200	200	350	900
intel	H	200	200	200	200	900
National Semi.	С	158	227	204	195	784
NEC	8	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
WafetScale	С	10	25		<u> 75</u>	<u> 185</u>
	N	2,135	1,915	1,940	1,450	7,440
	¢	383	572	619	<u> 820</u>	2,394
Total		2,518	2,467	2,559	2,270	9,834
Percentage Change from						
Previous Quarter	•	11	(18)	30	(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		\$2.96	\$2,67	\$2.76	\$2.92	\$2.80
Revenue (\$N)		7.2	6.6	7.,1	6.6	27.5
				1907		
		Lat	2nd	3rd	4th	
		<u>Qtr.</u>	Otr.	Qtr.	Otr.	Tear
Market Share						
u.s.		50.4%	50.36	48.41	63.7%	52.94
Japan		1.6	1.6	2.0	1.3	1.6
Burope		48.1	48.0	49.6	35.0	45.5
Total		100.00	100.04	100.00	100.04	100.0%

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

Source: Dataquest April 1988

Table 3

32K MOS EPROM Shipment Data, 1978–1987

			1976		_
NOS	lst	2nd	Jrd .	4th	-
Process	<u>Qts.</u>	Qtr.	Qtr.	Otr.	Year
и	N/A	N/A	N/A	N/A	0
С	N/A	N/A	N/A	N/A	0
N	N/A	H/A	N/A	N/A	0
c	N/A	H/A	N/A	H/A	0
N	H/A	H/A	N/A	N/A	0
N	N/A	N/A	N/A	8	0
N	N/A	N/A	N/A	N/A	0
				-	0
					0
					0
					0
			•		o o
				•	0
	•				5
*	N/A	8/A	<u>H/A</u>	N/A	
u	•	Δ	•		5
č	_	_	•	_	0
	0	0	0	5	5
-	o	ø	0	0	-
	0	0		5	
		_			
	-	-	-	_	#80.00
	0	0	0	0	\$80.00
	0	0	•	•	0
	ŭ	ů	•	•	v
			1978		
				4th	
	<u>Qtr.</u>	Qtr.	Otr.	<u>Qtr.</u>	Year
				•	
	0	0	0	0	0
	0	q	.0	0	0
	<u> 5</u>	<u>o</u>	<u>o</u>	<u>0</u>	<u>0</u>
	PTOCESS N C N C N N N N C N N N N N N N N N N	Process Ott. N N/A C N/A N N/A C N/A N N/A C N/A N O C N/A O O O O O O O O O O O O O O O O O O O	Process Qtr. Qtr. N N/A N/A C H/A N/A N/A N/A N N/A N/A	MOS 1st 2nd Jrd Process Qtr. Qtr. Qtr. N N/A N/A N/A N/A C N/A N/A N/A N/A N N/A N N/A N/A N N/A N N/A N/A N N/A N N/A N N/A N/A N N/	NOS

S = Sampling N/A = Not Available

Table 3 (Continued)

32K MOS EPROM Shipment Data, 1978–1987

				1979		
	MOS	lst	2nd	3rd	4th	
Company	Process	Otr.	Qtr.	Otr.	<u>Qtr.</u>	Year
AMD	н	N/A	N/A	N/A	N/A	0
Eurotechnique	С	N/A	N/A	N/A	N/A	0
Pujitsu	N	N/A	N/A	H/A	S	0
-	C	N/A	N/A	N/A	H/A	0
Hitachi	N	N/A	N/A	N/A	S	0
Intel	H	5	30	50	100	185
Mitsubishi	н	N/A	N/A	N/A	S	0
Motorola	N	N/A	N/A	N/A		0
National Semi.	¢	N/A	H/A	N/A	N/A	0
NBC	H	N/A	N/A	H/A	N/A	0
Ricoh	c	N/A	N/A	H/A	N/A	0
Rockwell	n	N/A	N/A	N/A	N/A	0
	c	N/A	H/A	N/A	N/A	0
SGS-Ates	N	H/A	N/A	H/A	N/A	0
Texas Instruments	N	10	35	60	90	195
Toshiba	И	H/A	<u>M/A</u>	<u>N/A</u>	<u>H/A</u>	
	N	15	65	110	190	360
	С	0	0	0		
Total		15	65	110	190	380
Percentage Change from Previous Quarter		0	3334	694	731	
		_				
Cumulative Total		20	85	195	385	
ASPs: NMOS		\$80.00	\$80.00	\$75.00	\$75.00	\$76.05
CM06		. 0	. 0	O.	0	0
Overall		\$80.00	\$80.00	\$75.00	\$75.00	\$76.05
Revenue (\$4)		1.2	5.2	8.3	14.3	28.9
				1979		
		lst	2nd	3rd	4th	
		Qtr.	Qtr.	Qtr.	Ote.	Year
Market Share						
U.S.		100.0%	100.00	100.09	100.0%	100.01
Japan		0	0	o	9	0
Eucope		0	0	0	0	0
Total		100.01	100.01	100.00	100.00	100.00

S = Sampling N/A = Not Available

Table 3 (Continued)

32K MOS EPROM Shipment Data, 1978–1987

			1980		
MOS	let	2nd	3rd	4th	
Process	Otr.	Otr,	Otr.	Otr.	Year
N	N/A	N/A	s	2	2
C	N/A	N/A	N/A	N/A	0
N	S	s	15	100	115
С	N/A	N/A	N/A	•	0
М	S			4	620
					1,190
		-			136
					145
	_				40
	. ,				20
					0
	-	-	-	-	0
_					0
					0
					1,250
N	<u>N/A</u>		5	10	15
N	320	706	1,020	1,447	3, 493
¢	0	_10	15	15	40
	120	716	1,035	1,462	3,533
	684	1240	450	419	
	705	1,421	2,456	3,918	
	\$55.00	\$40.00	\$30.00	\$10.00	\$26.03
	\$55.00	\$40.00	\$30.00	\$10.00	\$26.03
	17.6	28.2	30.6	14.5	90.9
			1980		
	lat	2nd	3ed	4th	
	Otr.	Otr.	Otr.	Otr.	Year
	100.04	82.4%	72.54	66.14	74.41
	0	17.6	27.5	33.9	25.6
	0	17.6 0	27.5	33.9 0	25.6 0
	Process NCCNCCNNCCNNCCNNCCNNCCNNCCNNCCNNCCNNC	Process Ott. N N/A C N/A N S C N/A N 165 N S N 165 N N/A C N/A N N/A C N/A N N/A C N/A N N/A C N/A N 150 N N/A T 150 N N/A N 150 N N/A N 150 N 17.6	Process Qtr. Qtr. N N/A N/A C N/A N/A N S S C N/A N/A N S 120 N 165 250 N S 6 N S 30 C S 10 N N/A N/A N 150 300 N N/A N/A N 150 300 N N/A S N	MOS 1st 2nd 3rd Process Qtr. Qtr. Qtr. Qtr. Qtr. Qtr. Qtr. Qtr.	MOS

S = Sampling N/A = Not Available

Table 3 (Continued)

32K MOS EPROM Shipment Data, 1978–1987

				1981		
	MOS	lst	2nd	Jed	4th	
Company	Process	Otr.	Qtr.	Otr.	Otr.	<u>Year</u>
AMD	N	10	100	120	310	540
Eurotechnique	c	H/A	N/A	ş	5	5
Pujitsu	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	o
Rockwell	N	H/A	N/A	N/A	N/A	0
	c	N/A	H/A	N/A	N/A	Q
SGS-Ates	19	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
	¢	10	20	30	35	95
Total		2,110	2,755	4,545	6,885	16,295
Percentage Change from Previous Quarter		445	311	65%	514	
Cumulative Total		6,028	6,783	13,326	20,213	
ASPs: NWOS		\$9.00	\$8.00	87.00	\$5.80	\$6.92
CHOS		0	0	0	0	0
Overall		\$9.00	\$0.00	\$7.00	\$5.80	\$6.92
Revenue (\$M)		18.9	21.9	31.6	39.7	112.1
				1981		
		lst	2nd	3rd	4th	
		Qtc.	Qtr.	Otr.	Otr.	Year
Market Shace						
U.\$.		58.3%	59.54	51.7%	47.8%	52.2%
Japan		41.7	40.5	48.3	52.1	47.7
Entobe		0	0		0	0
Total		100.00	100.00	100.04	100.04	100.05
S = Sampling						

5 = Sampling N/A = Not Available

Table 3 (Continued)

32K MOS EPROM Shipment Data, 1978–1987

				1982		
	MOS	lst	2nd	Jrd	4th	
Company	Process	Otr.	Otr.	Otr.	Otr.	Year
AMD	N	600	1,050	650	850	3,150
Eurotechnique	С	30	100	150	200	480
Pujitsu	N	600	700	1,000	1,200	3,500
•	¢	N/A	N/A	H/A	S	0
Hitachi	N	1,500	2,500	2,500	2,500	9,000
Intel	H	2,000	2,500	2,500	2,500	9,500
Mitsubishì	H	1,450	1,500	1,800	1,500	6,250
Motorola	и	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	H/A	N/A	N/A	0
Rockwell	И	N/A	N/A	H/A	H/A	0
	c	H/A	N/A	N/A	H/A	0
SGS-Ates	N	5	10	25	50	85
Texas Instruments	Я	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%	1.26	34	
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 (SM)		51.5	60.3	60.4	58.9	231.0
				1982		
		lst	2nd)¢d	4th	
		Otr.	Otr.	Qtr.	<u>Qtr.</u>	<u>Year</u>
Market Shace						
U.S.		40.34	39.0%	33.50	35.04	36.61
Japan		59.3	60.0	65.1	63.0	62.1
Europe		0.3	1.0	1.4	1.9	1.3
Total		100.04	100.09	100.00	100.00	100.00
•						

S = Sampling N/A = Not Available

Table 3 (Continued)

32K MOS EPROM Shipment Data, 1978–1987

3rd 0tc. 00 1,200 00 400 00 1,500 00 3,500 00 2,200 00 1,500 00 600 00 1,700 A H/A A N/A A S 0 100 0 3,000	4th Qtx. 1,500 400 1,500 50 3,000 1,900 1,300 800 1,700 S N/A 25 100 3,500 500	Year 4,500 1,300 5,700 135 13,000 9,000 6,100 0 2,200 8,300 0 0 25,350 9,500 2,000
1,200 1,200 1,500 1,500 1,500 1,500 1,500 0,1,500 0,00 1,700 A A A A A A A A A A A A A A A A A A	1,500 400 1,500 50 3,000 1,900 1,300 0 800 1,700 S N/A 25 100 3,500	4,500 1,300 5,700 135 13,000 9,000 6,100 2,200 8,300 0 25 350 9,500
00 400 1,500 15 50 10 3,500 10 2,200 10 1,500 0 600 0 1,700 A N/A A N/A S 0 100 0 3,000	400 1,500 50 3,000 1,800 1,300 0 800 1,700 S N/A 25 100 3,500	1,300 5,700 135 13,000 9,000 6,100 0 2,200 0 0 0 0 2,300 0 2,300 0 3,300 9,500
1,500 15 50 10 3,500 10 2,200 10 1,500 0 0 0 1,700 A N/A A N/A A S 0 100 0 3,000	1,500 50 3,000 1,000 1,300 0 800 1,700 S N/A 25 100 3,500	5,700 135 13,000 9,000 6,100 2,200 8,300 0 0 25 350 9,500
55 50 10 3,500 10 2,200 10 1,500 1,500 1,500 1,700	50 3,000 1,000 1,300 0 0 0 0 0 1,700 5 N/A 25 100 3,500	135 13,000 9,000 6,100 0 2,200 8,300 0 0 25 350 9,500
3,500 0 2,200 0 1,500 0 600 0 600 0 1,700 A H/A A H/A S 0 100 0 3,000	3,000 1,800 1,300 0 800 1,700 S N/A 25 100 3,500	13,000 9,000 6,100 0 2,200 8,300 0 0 25 350 9,500
2,200 0 1,500 0 0 0 600 0 1,700 A M/A A N/A S 0 100 0 3,000	1,800 1,300 0 800 1,700 S N/A 25 100 3,500	9,000 6,100 0 2,200 8,300 0 0 25 350 9,500
0 1,500 0 0 0 600 0 1,700 A M/A A M/A A S 0 100 0 3,000	1,300 0 800 1,700 S N/A 25 100 3,500	6,100 0 2,200 8,300 0 0 25 350 9,500
0 0 600 0 1,700 A N/A A N/A A S 0 100 0 3,000	0 800 1,700 S N/A 25 100 3,500	0 2,200 8,300 0 0 25 350 9,500
0 600 0 1,700 A N/A A N/A A S 0 100 0 3,000	800 1,700 S N/A 25 100 3,500	2,200 8,300 0 25 350 9,500
0 1,700 A H/A A H/A A S 0 100 0 3,000	1,700 S N/A 25 100 3,500	8,300 0 0 25 350 9,500
A H/A A H/A A S O 100 O 3,000	\$ N/A 25 100 3,500	0 0 25 350 9,500
A N/A A N/A A S O 100 O 3,000	N/A 25 100 3,500	0 25 350 9,500
A S 0 100 0 3,000	25 100 3,500	25 350 9,500
0 100 0 3,000	100 3,500	350 9, 500
0 3,000	3,500	9,500
	500	2,000
500		
0 15,200	14,900	56,450
5 1,050	1,275	3,660
5 16,250	16,175	62,110
1 21	09	_
3 111,283	127,458	
0 \$3.75	\$3.75	\$3.96
0 0	0	4
0 \$ 3.75	\$3.75	\$3.98
57.0	55.9	232.9
1983		
	4th	
	Qtr.	Year
	47.19	40.61
c. Otr.		56.7
. <u>Qtr.</u>		2.7
.24 43.14 .3 53.8	-3.1	100.00
	7.24 43.18	d 3rd 4ch :r. Qtr. Qtr. 7.24 43.14 47.14 0.3 53.8 49.8

(Continued)

S = Sampling N/A = Not Available

Table 3 (Continued)

32K MOS EPROM Shipment Data, 1978–1987

				1984		
	NOS	lat	2nd	3ed	4th	
Company	Process	<u>Qtr.</u>	Otr.	Otr.	Qtr.	<u>Year</u>
AMD	м	1,600	1,800	2,200	2,200	7,800
Fujitsu	N	1.600	1,600	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
Motorole	N	0	0	D	0	0
National Semi.	C	900	1,000	1,100	850	3,850
NBC	N	1,400	1,550	1,000	750	4,700
Ricoh	С	Ş	5	50	100	150
Rockwell	H	N/A	N/A	S	S	.0
	¢	50	25	0	0	75
ses	М	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	H	300	150	50	25	525
	N	14,300	14,350	12,700	10,975	52,325
	С	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)	19	(104)	(140)	
Stearone Angites		(34)	14		11441	
Cumulative Total		143,208	159,133	173,533	165,958	
ASPS: 1840S		\$3.60	\$3.50	\$3.25	\$3.10	\$3.30
CMOS		\$7.50	\$7.50	\$7.25	\$7.00	\$7.31
Overall		\$3.96	\$3.90	\$3.72	\$3.56	\$3.80
Revenue (\$8)		62.4	62.0	53.6	44.2	222.2
				1984		
		lat	2nd	3cd	4th	
		Otc.	Otr.	Qtr.	Otr.	Year
Market Share						
U.S.		51.70	54.29	59.04	58.44	55.6%
Japan		44.8	41.8	34.7	31.6	36.7
Europe		3.5	4.1	_6.3	10.1	5.7
Total		100.04	100.0%	100.00	\$0.001	100.0%
S = Sampling						

S = Sampling N/A = Not Available

Table 3 (Continued)

32K MOS EPROM Shipment Data, 1978–1987

				1985		
	HOS	lst	2nd	3rd	4th	
Company	Process	Otr.	Qtr.	Otr.	Otr.	Year
AMD	N	2,200	2,450	1,750	1,300	7,700
Fajitsu	W	800	600	300	250	1,950
	C	250	250	250	150	900
Rítachi	N	900	700	400	400	2,400
Intel	N.	1,600	1,500	1,500	1,500	6,300
Mitsubishi	N	650	1.000	450	300	2,400
Motorola	N	0	. 0	a	0	. 0
National Semi.	c	700	600	500	500	2,300
NEC	N	730	500	600	530	2,560
Ricoh	Ĉ	150	200	200	150	700
Rockwell	Ň	50	50	- 0	0	100
	Ċ	q	0	ŏ	ō	0
5GS	Ň	800	700	850	1,000	3,350
Texas Instruments	N	1,800	1.600	1,500	1,200	6,100
Thomson-Eurotechnique	Ċ	350	400	400	400	1,550
Toshiba	Ň	0		0	0	0
	H	9,730	9,100	7,550	6,400	32,660
	С	1,450	1,450	1,350	1,200	5,450
Total		11,160	10,550	8,900	7,680	36,310
Percentage Change from						
Previous Quarter		(10%)	(64)	(16%)	(149)	
Cumulative Total		197,138	207,688	216,588	224,260	
ASPs: NHOS		#2.80	\$2.25	\$2.20	\$2.20	42.39
CHOS		\$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
				1985		
		Lst	2nd	3rd	4th	
		Qtr.	Qtr.	Qtr.	Qtr.	Year
Market Share						
U.S.		58.6%	58.8%	59.0%	58.6%	58.7%
Japan		31.1	30.8	27.0	23.2	28.5
Entobe		10.3	10.4	14.0	18.2	12.6
Total		100.04	100.00	100.0%	100.01	100.00

Table 3 (Continued)

32K MOS EPROM Shipment Data, 1978–1987

			_	1986		
	MOS	lat	2nd	300	4th	
Company	Process	Otr.	Qtr.	Qtr.	Qtr.	Year
AMD	N	950	850	675	450	2,925
Pujitsu	N	150	50	O O	O	200
• • •	С	50	0	0	0	50
Hitachi	Я	500	200	100	50	650
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	30 0	1,300
NEC	N	330	270	150	100	850
Ricoh	С	50	50	0	٥	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	¢	300	300	300	300	1,200
	N	4,943	4,270	4,757	4,957	18,927
	С	800	650	600	600	2,650
Total		5,743	4,920	5,357	5,557	21,577
Percentage Change from Previous Quarter		(25%)	(14%)	94	44	
Cumulative Total		230,011	234,931	240,280	245,845	
ASPs: NHOS		\$2.10	\$2,15	\$2.20	\$2.25	\$2,18
CHOS		\$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		
		Lat	2nd	3rd	4th	
		Otr.	Otr.	Otr.	Otr.	Year
Macket Share						
U.S.		67.9%	75.20	62.11	70.2%	68.74
Japan		16.8	11.6	9.9	2.6	10.8
Europe		13.3	13.2	28.0	27.0	20.5
Total		100-04	100.00	100.04	100.04	100.00

Table 3 (Continued)

32K MOS EPROM Shipment Data, 1978–1987

			1987				
	MOS	1st	2nd	3rd	4th		
Company	Process	Otr.	Otr.	Otr.	Otr.	Year	
AMD	10	425	500	475	575	1,975	
Fujit su	N	0	0	0	0	Q	
	c	0	0	o.	0	0	
Hítachi	N	Q	0		0		
Intel	н	1,050	1,300	1,100	1,100	4,550	
	OTP	0	0	0	0	0	
Mitsubishi	N	0	0	-0	-	-	
National Semi.	Ç	750	750	744 20	62 8 10	2,872 150	
NBC	N	1 00 0	20 g	20	10	120	
Ricoh	c	6 8 5	559	471	560	2.275	
SGS-Thomson	. N	75	65	50	45	235	
Texas Instruments	N N	-		1,000	800	4,300	
Lexas Tuectnments	ta.	1,500	1,000	1,000		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	3,710	16,357	
Percentage Change from					•		
Previous Quarter		(174)	(94)	(86)	(49)		
Cumulative Total		250,430	254,624	258,484	262,202		
ASPs: NHOS		\$2.50	\$2.75	\$2.90	\$3.00	\$2.77	
CMO6		\$2.90	\$3.00	\$3.20	83.25	\$3.00	
Overall		\$2.57	\$2.80	\$2.96	\$3.05	\$2.83	
Revenue (\$M)		11.8	11.7	11.4	11.3	46.3	
				1987			
		lst	2nd	3rd	4¢b		
		Otr.	Otr.	Otr.	<u>Qtr.</u>	Year	
Market Share							
U.S.		81.24	84.6%	86.0%	83.5%	63.7%	
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%	100.00	100.04	100.00	100.0%	

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

Source: Dataquest April 1988

Table 4

64K MOS EPROM Shipment Data, 1980-1987

				1980		
	MOS	lst	2nd	3ed	4th	
Company	Process	Qtr.	Otr.	Qtr.	Qtr.	Year
AMD	И	N/A	N/A	N/A	N/A	0
Fujitsu	N	N/A	N/A	N/A	N/A	0
-	С	N/A	N/A	N/A	N/A	0
Hitachi	N	N/A	R/A	N/A	5	0
	C	H/A	N/A	H/A	H/A	0
Intel	19	N/A	N/A	N/A	8	0
	N	N/A	N/A	N/A	N/A	0
Mítsubishí	N	N/A	N/A	N/A	N/A	0
Mostek	H	H/A	H/A	N/A	9	0
Motorola	N	S	\$	5	\$	10
NBC	N	M/A	N/A	N/A	N/A	0
Oti Stannin	и С	N/A N/A	H/A N/A	N/A N/A	H/A N/A	ű
Oki Blectric Ricoh	č	N/A	N/A	N/A	N/A	ŏ
Rockwell	ñ	N/A	N/A	N/A	N/A	ă
10011122	Ċ	N/A	N/A	H/A	H/A	0
Seeq	N	H/A	H/A	N/A	H/A	ō
Seiko-Epson	č	N/A	H/A	N/A	N/A	ò
SGS-Ates	Ň	N/A	N/A	N/A	N/A	ē
Sharp	c	N/A	N/A	N/A	N/A	e e
Signetics	c	N/A	N/A	N/A	N/A	0
Texas Instruments	N	N/A	s	10	20	30
Toshibe	N	N/A	N/A	N/A	N/A	0
VLSI Technology	С	H/A	N/A	H/A	N/A	0
WaterScale Integ.	N	N/A	N/A	<u>H/A</u>	N/A	0
	H	0	0	,15	25	40
	c	0	0	<u>, o</u>	0	0
Total		0	.0	15	25	40
Percentage Change from Previous Quarter		0	0	o	674	
Cumulative Total		0	0	15	40	
ASP8: NMOS		0	0	0	0	0
CHUS		0	0	0	9	Q
Ovecall		\$200.00	\$100.00	\$80.00	\$70.00	\$73.75
Revenue (\$N)		0	0	1.2	1.8	3.0
				1980		
		lst	2nd	3rd	4th	
		Otr.	Otr.	Otr.	Otr.	Year
Market Share						
U.S.		0	0	100.0%	100.01	100.00
Japan		0	0	0	Ó	0
Burope	•	_0	_0	0	0	0
Total		0	0	100.0%	100.04	100.00
S = Sampling						

S = Sampling N/A = Not Available

MOS EPROM—Data

Table 4 (Continued)

64K MOS EPROM Shipment Data, 1980–1987

				1981		
	MDS	lst	2nd	3rd	4th	
Company	Process	Qtr.	Otr.	Qtr.	Otr.	Year
AND	N	N/A	H/A	N/A	N/A	0
Pujitsu	N	s	1	15	100	116
	c	N/A	N/A	N/A	N/A	0
Hitachi	H	S	2	5	25	32
	С	H/A	N/A	N/A	H/A	0
Intel	N	10	70	200	500	7 80 0
	N N	N/A N/A	N/A N/A	N/A N/A	H/A S	0
Mitsubishi Mostek	N	n/A S	2	5	3	70
Motorola	N	15	40	30	50	135
NBC	N	H/A	H/A	N/A	s	0
	Ċ	H/A	N/A	H/A	H/A	0
Oki Blectric	И	N/A	N/A	N/A	H/A	0
Ricoh	С	A/R	H/A	N/A	N/A	0
Rockwell	H	N/A	H/A	H/A	N/A	0
	c	N/A	N/A	H/A	N/A	0
Seeq	N	N/A	N/A	H/A	H/A	0
Selko- Spaon	c	N/A	N/A	N/A	N/A	0
SGS-Ates	N	H/A	N/A	N/A	R/A	0
Sharp	ç	N/A	M/A	N/A	N/A	0
Signetics	c	H/A	N/A	N/A	N/A	0
Texas Instruments	N	30	65	100	100	295
Toshibe	H	H/A	H/A	H/A	H/A	0
VLSI Technology	C	H/A	H/A	N/A	N/A	0
WaferScale Integ.	N	<u> N/A</u>	<u>N/A</u>	N/A	<u>H/A</u>	0
	N	55	180	355,	778	1,368
	c	_0	0		_0	
Total		55	180	355	778	1,368
Percentage Change from						
Previous Quarter		1200	2271	97%	1194	
Cumulative Total		95	275	630	1,408	
ASPs: NMOS		0	0	0	0	0
CNOS		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
				1981		
		lat	2nd	3rd	4£h	
		Otr.	Qtr.	Qtr.	Otr.	Year
Market Share						
U.S.		100.04	98.3%	94.48	93.94	89.2%
Japan		0	1.7	5.6	16.1	10.8
Europe		0	0	0	0	0
Total		100.0%	100.01	100.00	100.04	100.00

S = Sampling N/A = Not Available

Table 4 (Continued)

64K MOS EPROM Shipment Data, 1980-1987

	MOS	lst	2nd	3rd	4th	
Company	Process	Otr.	Qtr.	Qtr.	Qtr.	Year
AMD	н	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	29	800	1,700	2,500	2,500	7,500
	М	H/A	R/A	N/A	N/A	0
Mitsubishi	Ж	s	15	500	1,400	1,915
Mostek	N	0	0	0	. 0	0
Motorola	N	60	100	100	100	3 6 0 270
NEC	N	S	10	60	200	
ALC =4	И С	H/A N/A	N/A H/A	N/A N/A	N/A S	0
Oki Electric Ricoh	C	N/A	N/A	N/A	N/A	Ů
Rockwell	N	N/A	N/A	N/A	N/A	ő
HDCKAGTT	C	N/A	N/A	N/A	N/A	ŏ
5	и	H/A	n/A S	7/0	15	20
Seeq	Č	N/A	N/A	N/A	N/A	20
Seiko-Epaon SGS-Atea	N N	N/A	N/A	N/A	N/A	ő
Sharp	č	N/A	N/A	N/A	B/A	ŏ
Signetics	č	N/A	N/A	H/A	N/A	ŏ
Texas Instruments	Ň	100	100	100	100	400
Toshiba		N/A		20	50	70
VLSI Technology	ë	N/A	N/A	N/A	H/A	ő
WaferScale Integ.	n	M/A	<u> </u>	N/A	H/A	ŏ
Materscate integ.	•		<u> </u>			
	N	1,460	3,165	5,635	7,665	17,945
	C	10	<u>25</u>	50	100	185
Total		1,470	3,210	5,685	7,765	10,130
Percentage Change from						
Previous Quarter		094	1104	774	379	
Cumulative Total		2,878	6,088	11,773	19,538	
ASPs: NMOS		0	0	0	0	0
CHOS		q	0	0	0	0
Overall		\$15.00	\$11.50	\$8.50	\$6.50	\$8.70
Revenue (SPI)		22.1	36.9	46.3	50.5	157.8
				1982		
		Let	2nd	3rd	4th	
		Otr.	Otr.	Ote.	Otr.	Year
Market Share						
U.S.		65.30	59.5%	52.0%	41.49	49.90
Japan		34.7	40.5	48.0	58.6	50.1
Europe		0	0	0	0	0
Total		100.0%	100.04	100.00	100.04	100.04

S = Sampling N/A = Not Available

Table 4 (Continued)

64K MOS EPROM Shipment Data, 1980–1987

	HOS	lst	2nd	1983 3rd	4th	
Company	Process	Otr.	Otr.	Ott.	Otr.	Year
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	ş	50	50	100
Intel	н	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		
Motorela	N	150	200	450	700	1,500
NBC	N	350	500	500	600	1,950
** *	¢	N/A	N/A	N/A	N/A	. 0
Oki Electric	W	25	50	100	200	375
Ricoh	C	N/A	H/A	H/A	N/A	0
Rockwell	N	N/A	H/A	N/A	N/A	-
*	Ç	H/A	N/A 100	N/A 310	H/A 600	0 1,035
Seeq	N	25	_			-
Seiko-Epson	Ç N	N/A	N/A	N/A	N∕A S	0
SGS-Ates		N/A	H/A	N/A	-	0
Sharp	C	N/A	H/A	N/A S	N/A S	ŏ
Signetics Texas Instruments	C N	H/A 400	N/A 800	1,500	2,000	4.700
Toshiba	N	200	400	400	600	1,600
VLSI Technology	C	H/A	N/A	N/A	N/A	1,400
WaferScale Integ.	n	H/A	N/A	N/A	N/A	<u>.</u>
waretocate micey.						¥
	N	10,150	13,150	17,760	22,30 0	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		344	294	35%	25%	
Cumulative Total		29,938	43,386	61,548	64,296	
ASPs: NMOS		0	0	0	0	0
CMOS		0	0	0	9	0
Overall		\$5.50	\$4.75	\$5.00	\$5.50	\$5.20
Revenue (\$M)		57.2	63.9	90.8	125.1	337.0
				1983		
		lat	2nd	3rd	4th	
		Qtr.	Qtr.			Y
		Acres	A-++	Qtr.	Otr.	Teer
Market Share						
v.s.		40.1%	40.9%	41.6%	37.8%	39.94
Japan		59.9	59.1	58.4	62.2	60.1
Entobe		0		0	0	0
Total		100.00	10.001	100.01	100.00	\$0.001

S = Sampling N/A = Not Available

Table 4 (Continued)

64K MOS EPROM Shipment Data, 1980-1987

		1984						
	MOS	lst	2nd	3rd	4£b			
Company	Process	Otr.	Qtr.	Otr.	Ote.	Year		
AND	N	1,200	1,300	1,600	1,700	5,800		
Pujitsu	N	2,500	2,800	3,000	3,000	11,300		
-	c	500	600	700	900	2,700		
Hitachi	н	4,000	5,000	6,000	6,400	21,000		
	¢	100	250	300	350	1,000		
Intel	и	2,000	2,000	2,000	2,000	8,000		
	N	H/A	N/A	N/A	5,000	0 21,400		
Mitsubishi	N N	5,000 0	5,700 Q	5,700	3,000	21,400		
Hostek	N	900	900	600	500	2.900		
Motorola NBC	N	800	1,400	900	1,200	4,300		
MEC	č	N/A	N/A	N/A	s	0		
Oki Electric	Ñ	400	600	500	400	1,900		
Ricoh	č	H/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	С	N/A	N/A	N/A	N/A	0		
SGS	H	50	150	350	600	1,150		
Sharp	С	N/A	N/A	N/A	N/A	0		
Signetics	C	s	10	10	10	30		
Texas Instruments	M	2,400	2,600	2,800	2,400	10,200		
Toshiba	N	400	1,200	800	500	2,900		
VLSI Technology	¢	N/A	H/A	N/A	H/A	0		
WaferScale Integ.	H	N/A	N/A	<u> H/A</u>	N/A	0		
				25,300	24.400	94,810		
	N	20,450	24,660					
	C	610	910	1,035	1,360	3,915		
Total		21,060	25,570	26,335	25,740	98,725		
Percentage Change from						,		
Previous Quarter		(7%)	211	3\$	(24)			
Cumulative Total		105,358	130,926	157,263	183,023			
ASPs: NOOS		\$5.25	\$5.25	\$4.75	\$4.25	\$4.86		
CHOS		\$15.00	\$15.00	\$13.50	\$10.00	\$12.07		
Overall		\$5.53	\$5.60	\$5.09	\$4.55	\$5.18		
Revenue (\$4)		116.5	143.1	134-1	117.3	511.1		
				1964	_			
		lst	2nd	Jed	4th			
		Otr.	Otr.	Qtr.	Qtr.	Lest		
Market Share								
u.s.		34.7%	30.86	30.6%	29.9%	31.30		
Japan		65.1	68.6	68.1	67.7	67.5		
Europe		0.2	0.6	1.3	2.3	1.2		
Total		100.00	100.01	100.01	100.00	100.0%		

S = Sampling N/A = Not Avaitable

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

· ·		1965					
	(MOS	lst	2nd	3rd	4th		
Company	Process	Otr.	Otc.	Otr.	Qtr.	Year	
AMD	N	2,100	1,550	1,825	1,150	6,625	
Fujitau	H	3,500	3,500	3,800	3,500	14,300	
	c	600	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 0	2,600 0	4,300 0	4,200	15,950 0	
Mostek Motorola	N 19	400	300	300	400	1,400	
NEC	N	1,250	1,450	1,650	1,800	6,150	
(HEC)	ë	40	200	350	300	890	
Oki Electric	N	350	300	200	150	1,000	
Ricoh	¢	200	250	250	150	850	
Rockwell	N	0	0	O-	0	0	
	Ç	0	0	0	0	0	
Seeq	И	625	500	350	275	1,750	
Seiko-Epson	¢	N/A	H/A	N/A	8	0	
S GS	N	880	850	1,000	1,350	4,080	
Sharp	¢	N/A	N/A	N/A	8	o	
Signetics	c	0		0	0	0	
Texas Instruments	N	2,200	2,000	2,000	2,000	8,200	
Toehiba VLSI Technology	N C	800 N/A	600 S	500 20	350 40	2,250 60	
WaferScale Integ.	×	N/A	N/A	8	10	10	
waterscale integ.			<u></u>				
	N	25.000	21,925	24,075	22.825	93,905	
	¢	1,440	1,800	2,070	2,200	7,510	
Total		26,520	23,725	26,145	25,025	101,415	
Percentage Change from	1						
Previous Quarter		3%	(114)	100	(49)		
Cumulative Total		200 543	222 260	250 112			
Commutative total		209,543	233,268	259,413	284,438		
ASPa: NMOS		\$3.60	\$2.80	\$2.35	\$2.10	\$2.73	
CHOS		\$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	267.9	
				1965			
		let	2nd	3ed	4th		
		Otr.	Qtr.	Qtr.	Qtr.	Year	
Market Share							
v.s.		30.01	31.34	29.20	28.10	29.64	
Japan		66.7	65.1	66.9	66.5	66.4	
Europe		3.3	3.6	3.8	5.4	4.0	
Total		100.09	100.0%	100.01	100.04	100.01	
S = Sampling N/A = Not Available							

Table 4 (Continued)

64K MOS EPROM Shipment Data, 1980-1987

				1986		
•	MOS	let	2nd	3cd	4th	
Company	Process	Qtr.	Otr.	Otr.	Otr.	Year
AMD	N	850	800	900	1,385	3,935
	N	1,500	1,500	2,000	4,000	9,000
Pujitsu	c c	1,000	1,000	2,000	4,000	8,000
General Instruments	Č	1,000	0	31	170	201
General INstruments	OTP	N/A	N/A	s	10	10
Caldana	C	8	S	ŏ	5	- 5
Goldstar Hitachi	N	5.400	5,000	4,500	4.000	10,900
Hitachi	č	700	700	700	700	2,800
Hyundai	č	s	8	0	5	5
, Intel	N	3,400	3,300	2.400	3,200	12,300
, 10001	č	250	500	425	400	1,575
	NOTE	400	400	300	200	1,300
	COTP	`_Q	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	H	1,850	1,000	300	150	3,300
	C	800	1,000	490	300	2,590
	OTP	240	140	100	50	530
Ricoh	c	O	o	25	50	75
Seeq	28	525	615	315	150	1,605
Seiko-Epson	C	0	75	100	150	325
SGS	М	552	608	2,500	2,500	6,160
Sharp	c	9	5	10	15	30
	OTP	s	8	ο,	Q	0
Signetics	c	•	5	5	10	20
Texas Instruments	34	1,400	1,400	1,800	1,600	6,200
Toshibe	N	500	600	600	900	2,600
	OTP	700	400	500	500	1,500
VLSI Technology	Ç	40	40	40	50	170
WaferScale Integ.	c	0	10	10	10	30
Others	¢	0	0	5	\$	<u></u>
	N	20,691	19,438	20,369	22,042	82,540
	Ċ	3,055	3,560	4,221	6,230	17,086
	•	31033	21300	7/224	01270	17,000
Total		23,746	23,018	24,590	20,272	99,626
D						
Percentage Change from Previous Quarter		(50)	(3%)	79	15%	
-						
Cumulative Total		308,184	331,202	355,792	384,064	
ASPs: NNOS		\$2.15	\$2.35	\$2.60	\$2.75	\$2.47
CH0\$		\$3.50	\$3,75	\$3.85	\$4,10	\$3.86
Overall		\$2.32	\$2.57	\$2.61	\$3.05	\$2.71
Revenue (\$M)		55.2	59.1	69.2	86.2	269.7
				1005		
		lst	2nd	1986 3rd	4th	
		Otr.				v
Market Char-		Acre +	Otr.	Otr.	Otr.	Year
Market Share U.S.		29.99	J3.18	27.46	27.0\$	29.24
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
7-1-1		100.05	100.00	100.00	100.01	100.00
Total		100.04	100.04	100.00	100.04	100.04

S = Sampling N/A = Not Available

Table 4 (Continued)

64K MOS EPROM Shipment Data, 1980-1987

				1987		
	MOS	let	2nd	3rd	4th	
Company	Process	Qtr.	Qtr.	Otr.	Otr.	Year
AMD	н	1.300	1.500	1,150	1,750	5,700
Cypress	č	50	75	100	100	325
Fujitau	N	400	500	800	800	2,500
10,112	Ċ	1.800	2,000	2.200	2,200	8,200
Goldstar	c	5	5	5	5	20
Hitachi	Ň	2,500	1,500	1,000	0	5.000
	Ċ	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
	С	400	400	500	400	1,700
	N OTP	350	300	150	250	1,050
	COLS	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	H	125	100	86	60	371
	OTP	17	10	13	6	46
National Semi.	Ċ	606	1,198	1,580	2,341	5,725
	COTP	N/A	N/A	H/A	S	0
NBC	N	400	60	70	0	530
	¢	1,000	370	390	200	1,960
	OTP	0	0	0	0	0
Oki Electric	H	30	\$0	50	50	200
	N OTP	450	450	400	350	1,650
Ricoh	c	50	50	100 .	100	300
Seeq	E9	200	200	200	200	600
Seiko-Epeon	c	100	100	100	100	400
SGS-Thomson	R	872	1,643	2,081	2,100	6.696
	С	80	110	40	100	330
	C OTP	5	45	70	100	220
Sharp	С	0	80	150	250	480
•	OTP	Ö	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	С	75	100	100	100	375
WaferScale Integ.	¢	30	50	50	50	100
•						
	N	12,764	11,013	11,400	11,916	47,893
	¢	5,416	6,008	6,745	7,116	25, 205
Total		18,180	17,821	18,145	19,032	73,178

Table 4 (Continued)

64K MOS EPROM Shipment Data, 1980-1987

Percentage Change from					
Previous Quarter	(36%)	(2%)	24	5%	
Cumulative Total	402,244	420,065	430,210	457,242	
ASPs: NMOS	\$2.80	\$2.90	\$3.00	\$3.10	\$2.95
CH05	\$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		<u>. </u>
	lst	2nd	3r d	4th	
	Otr.	Otr.	Oft.	Qtr.	Year
Market Share					
U.S.	33.90	40.49	39.8%	49.4%	41.0%
Japan	60.8	49.4	46.0	36.4	49.0
Europe	5.3	10.1	12.1	12.1	9.9
ROW	0.1	-0.1	0.1	0.1	<u>0.1</u>
Total	100.00	100.00	100.00	100.00	100.00

S = Sampling N/A = Not Available Note: Columns may not add to totals shown because of counding.

Source: Dataquest April 1988

Table 5
128K MOS EPROM Shipment Data, 1982–1987

				1982	_	
	MOS	lst	2nd)rd	4th	
Company	Process	Qtr.	Otr.	Otr.	Otr.	Year
AMD	N	N/A	N/A	N/A	s	0
Fujitsu	14	N/A	H/A	N/A	S	0
	C	N/A	N/A	H/A	H/A	0
Hitachi	N	H/A	N/A	N/A	s	. 0
Intel	И	3	15	50	150	218
Mitsubishi	N	N/A	N/A	N/A	H/A	0
	С	N/A	N/A	N/A	N/A	0
NEC	M	H/A	H/A	H/A	N/A	0
Seeq	N	N/A	H/A	N/A	8	0
Texas Instruments	N	H/A	s	5	5	10
	c	N/A	H/A	N/A	N/A	0
Toshiba	N	N/A	N/A	N/A	N/A	N/A
	N	3	15	55	155	228
	С	0	0	_0		0
Total		3	15	55	155	228
Percentage Change from Previous Quarter		0	400%	267%	1824	
Cumulative Total		3	18	73	228	
Average Salling Price		\$75.00	\$60.00	\$50.00	\$40.00	\$44.19
Revenue (\$M)		0.2	0.9	2.8	6.2	10.1
	•			1982		
		let	2nd	3cd	4th	
		Qtr.	Qtr.	Otr.	Otr.	Year
Market Share						
U.S.		100.00	100.04	100.04	100.00	100.00
Japan		0	0	0	0	0
Europe		0	0		<u>ō</u>	<u>0</u>
Total		100.001	100.04	100.04	100.04	100.00

S = Sampling N/A = Not Available

Table 5 (Continued)

128K MOS EPROM Shipment Data, 1982-1987

			1983				
	NOS	lst	2nd	3rd	4th		
<u>Company</u>	Process	Qtr.	Otr.	Otr.	Qtr.	Year	
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	H	ş	10	10	10	30	
	C	N/A	N/A	N/A	N/A	0	
NEC	N	s	10	20	100	130	
Seeq	Я	H/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	<u></u> \$	10			<u>80</u>	
	N	520	1,105	1,900	2,960	6,485	
	С	0	10	25	35	70	
		520	1,115	1,925	2.995	6,555	
Total		320	1,113	1,929	2,333	0,333	
Percentage Change from Previous Quarter		2350	1148	730	569		
TOTAL GOLLEGE							
Cumulative Total		748	1,863	3,788	6,783		
Average Selling Price		\$30.00	\$22.00	\$17.00	\$16.00	\$18:44	
Revenue (\$H)		15.6	24.5	32.7	47.9	120.8	
				1983			
		lst	lad	Jrd"	4th		
		Otr.	Otr.	Otr.	<u>Otr.</u>	Year	
Macket Shace							
U.S.		96.29	87.49	80.54	70.11	78.2%	
Japan		3.8	12.6	19.5	29.9	21.8	
Europe							
mat ohe					0	0	
Total		100.00	100.04	100.00	100.0%	100.00	

S = Sampling N/A = Not Available

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

	1984							
	MOS	lst	2nd	3rd	4th			
Company	Process	Otr.	Otr.	Qtr.	Otr.	Year		
AMD	N	500	600	850	900	3,050		
Pujitsu	N	550	750	800	700	2,800		
,	c	50	75	100	100	325		
Hitachi	И	650	1,800	2,000	2,800	7,250		
Intel	н	1,500	1,600	1,700	2,200	7,000		
Mitsubishi	N	60	400	1,500	2,200	4,160		
	С	N/A	N/A	N/A	s	0		
NEC	N	20	160	600	1,000	1,780		
Seeq	91	150	400	525	575	1,650		
Texas Instruments	N	10	25	25	25	85		
	c	N/A	H/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		200	764	361	331			
Cumulative Total		10,373	16,683	25,283	36,683			
ASPs: NMOS		\$15.25	\$14.00	\$12.25	\$10.00	\$12,12		
CHOS		\$28.00	\$25.00	\$20.00	\$18.00	\$21.77		
Overall		\$15.43	\$14.13	\$12.34	\$10.07	\$12.22		
Revenue (\$19)		55.4	89.2	106.1	114.8	365.5		
				1984				
		Lat	2nd	3rd	4th			
		Otr.	<u>Qtr.</u>	Ote.	Otr.	Year		
Market Share								
U.S.		60.24	44.81	36.0%	32.5%	39.4%		
Japan		39.6	55.2	64.0	67.5	60.6		
Europe		0	0	0	9			
Total		. 100.00	100.01	100.01	100.01	100.01		
S = Sampling N/A = Not Available								

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

				1985		
	MOS	lst	2nd	3cd	4th	
Company	Process	Otr.	Ots.	Otr.	Qtr.	Year
AMD	N	1,150	950	850	900	3,850
Pujitsu	N	1,000	1,500	1,750	2,000	6,250
	C	100	100	100	100	400
Hitachi	н	3,000	3,200	3,500	3,100	12,800
Intel	N	2,000	1,800	2,000	2,200	0,000
Mitsubishi	И	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	H/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		225	<u> 550</u>
Total		11,980	13,085	14,410	16,350	55,825
Percentage Change from Previous Quarter		59	94	104	134	
Cumulative Total		40,663	61,748	76,158	92,500	
ASPs: NNOS		\$6.50	\$4,10	\$3.10	\$2.60	#3-92
CNOS		\$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		
		lst	2nd	3rd	4th	
		Otr.	Otr.	Qtr.	<u>Qtr.</u>	Year
Market Share						
U.S.		29.8%	23.5%	21.50	20.59	23.5%
Japan		70.2	76.5	78.5	79.5	76.5
gurope			0	0	0	
Total		100.00	100.00	100.04	100.04	100.00

S = Sampling N/A = Not Available

Table 5 (Continued)

128K MOS EPROM Shipment Data, 1982-1987

				1986		
	MOS	Lat	2nd	3rd	4 t h	
Company	Process	Otr.	Ote.	Otr.	Otr.	Year
AMD	N	1.300	1,100	1,050	1,715	5.165
Pujitsu	N	800	800	800	800	3,200
•	¢	100	100	100	100	400
General Instrument	c	N/A	s	20	150	170
	OTP	N/A	N/A	s	T0	10
Hitachi	H	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
	Ç	75	70	90	120	355
	N OTP	650	650	530	300	2,150
	COTP	Đ	0	0	0	0
NEC	H	3,110	3,000	1,520	1,000	8,630
Seeq	N	325	325	300	225	1,175
Seiko-Epson	M	Q	10	15	25	50
Texas Instruments	N	N/A	N/A	N/A	N/A	0
	С	100	175	225	400	900
Toshiba	N	700	700	700	60 0	2,700
	OTP	50	20 0	400	60 0	1,250
VLSI Technology	С	5	10	10	10	3\$
WaferScale Integ.	¢		0	5	5	10
Others	C	N/A	<u>s</u>	5	10	15
	H	14,835	14,735	13,085	12,780	55,435
	С	280	355	455	805	1,895
Total		15,115	15,090	13,540	13,505	57,330
Percentage Change from						
Steafong Gnerget		(84)	Q	(104)	0	
Cumulative Total		107,623	122,713	136,253	149,123	
ASPs: NMOS		\$2.55	\$2.65	\$2.75	\$2.75	\$ 2.67
CH08		\$3.70	\$3.90	\$4.00	\$4.00	\$ 3.94
Overall		\$2.57	\$2.68	\$2.79	\$2.82	\$ 2.71
Revenue (\$P()		38.9	40.4	37.8	38.4	155.5
				1986		
		Lst	2nd	3rd	4th	
		Otr.	Otr.	Otc.	<u>otr.</u>	Year
Market Share						
U.S.		27.3%	31.20	37.49	42.94	34.49
Japan		72.7	68.8	62.6	57.0	65.6
Europe		0.0	0.0	0.0	1.0	0.0
Total		100.0%	100.01	100.0%	100.0%	100.0
C a Cappling						

S = Sampling N/A = Not Applicable

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

				1987		
	HOS	lst	2nd	3rd	4th	
Company	Process	Otr.	Ote.	<u>Qtr.</u>	Otr.	A491
AMD	H	1,300	1,925	1,725	1,875	6,825
Pujitsu	'n	1,000	1,200	1,100	1,100	4,400
10,110	Ċ	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
	COTP	Q.	0	20	20	40
Microchip Tech., Inc.	C	200	250	420	400	1,270
	COTP	20	45	80	200	345
Mitsubishi	H	1,150	1,300	1,400	950	4,800
	Ç	10	100	130	60	330 770
	N OTP C OTP	120 0	250 0	300 0	100 0	770
National Semi.	C	222	191	223	390	1,026
NEC	N	900	590	430	330	2,250
Oki Electric	H	100	130	100	100	450
OKI BIGGETTE	N OTP	400	450	400	350	1,600
Seeq	N OIF	150	150	100	100	500
Seiko-Epson	H	-30	10	15	25	50
SGS-Thomson	Н	178	525	1,157	1,700	3,560
Texas Instruments	N	0	25	25	70	120
	c	800	900	1,000	1,200	1,900
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.	С	<u>s</u>	0		5	10
	19	11,698	12,925	11,572	10,690	46,805
	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		69	134	(5%)	(35)	
•		-		•		
Cumulative Total		162,708	178,029	192,639	206,814	
100-		A.	4	.		
ASPE: NHOS		\$3.00	#3.35	\$3.45	\$3.75	\$ 3.30
CMOS		\$3.90	\$3.80	\$3,90	\$4.25	\$ 3.99
Overall		\$3.13	\$3.42	\$3.54	\$3.87	\$ 3.49
Revenue (SM)		42.5	52.4	51.8	54.9	201.5
				1967		
		lat	2nd	3rd	4th	
		Qtr.	Otr.	Qtr.	Qtr.	<u> 189Y</u>
Market Share						
U.S.		41.9%	42.19	36.19	49.11	43 40
Japan		56.8	54.5	56.0	38.9	42.30
Europe		1.3	_3.4	7.9		51.6
					12.0	6.2
Total		100.0%	100.0%	100.0%	100.01	100.01

 $S \Rightarrow Sampling \\ N/A \Rightarrow Not Applicable \\ Note: Columns may not add to totals shown because of rounding.$

Source: Dataquest April 1986

Table 6
256K MOS EPROM Shipment Data, 1983-1987

		1963					
	MOS	lst	2nd	3rd	4th		
<u>Company</u>	Process.	Qtr.	Qtr.	Otr.	Qtr.	Year	
AMD	и	H/A	s	10	25	35	
Atmel	N	N/A	N/A	H/A	H/A	0	
	C	N/A	N/A	R/A	N/A	0	
Fojitsu	H	N/A	N/A	H/A	N/A	.0	
C	C N	S N/A	S N/A	5 N/A	20 N/A	25 0	
General Instrument	Č	N/A	8/A	N/A	N/A	ů	
Hitachi	19	N/A	N/A	N/A	N/A	ŏ	
	č	H/A	N/A	N/A	N/A	ā	
Intel	N	5	10	35	90	140	
	- с	H/A	N/A	N/A	N/A	0	
Mitsubishi	N	N/A	N/A	H/A	s	0	
National Semi.	c	N/A	N/A	N/A	N/A	0	
NEC	N	N/A	H/A	N/A	5	0	
	c	N/A	H/A	H/A	N/A	0	
Seeq	c	N/A	, N/A	N/A	N/A	0	
Seiko-Epson	C	N/A	N/A	N/A	M/A	0	
SGS-Ates	ĸ	N/A	H/A	H/A	N/A	0	
Texas Instruments	C N	H/A	H/A N/A	N/A N/A	N/A	ŏ	
Toshiba	Ç	H/A N/A	N/A	N/A	N/A	0	
VLSI Technology	č	N/A	N/A	N/A	N/A	ŏ	
WaferScale Integ.	č	N/A	N/A	N/A	N/A	ŏ	
marcious integ.	•	- 17 14	19.55			<u> </u>	
	N	5	10	45	115	175	
	c	0	0	5	20	25	
Total		5	10	50	135	200	
Percentage Change from		o	1000	400%	1700		
Previous Quarter		ď	1004	4004	1700		
Cumulative Total		5	15	65	200		
ASPs: NMOS		\$150	\$125	\$100	\$95	\$100	
CHOS		0	0	\$145	\$115	\$121	
Overall		\$150	\$125	\$105	\$98	\$102	
Revenue (\$M)		0.8	1.3	5.2	13.2	20.5	
				L983			
		lst	2nd	3rd	4th		
		Otr.	Qtr.	Otr.	Qtr.	Year	
Market Share							
v.s.		100.0%	100.01	100.00	100.00	100.01	
Japan		0	0	0	0	0	
Europ e		0	0	0	0	0	
Total		100.00	100.04	100.00	100.00	100.01	
					-		

S = Sampling N/A = Not Available

Table 6 (Continued)
256K MOS EPROM Shipment Data, 1983–1987

				1984		
	MQS	lst	2nd	3rd	4th	_
Company	Process	Otr.	Otr.	Otr.	Qtr.	Year
AMD	N	100	130	100	250	580
Atmel	19	N/A	N/A	N/A	N/A	0
	c	N/A	N/A	H/A	N/A	0
Fujitsu	Ħ	N/A	N/A	N/A	10	10
	C	30	40	50	75	195
General Instrument	N	N/A	N/A	N/A	H/A	0
	Ç	N/A	B/A	N/A	N/A S	0
Hitachi	N C	N/A N/A	H/A H/A	S	5 5	ū
Intel	N N	150	250	375	475	1,250
rucet	Ċ	N/A	N/A	N/A	N/A	0
Mitsubishi	N	S	5	.,,,	5	5
National Semi.	č	H/A	N/A	N/A	N/A	á
NEC	Ň	8	s	S		5
	ç	N/A	N/A	N/A	N/A	ō
Seeq	č	H/A	s	s	5	5
Seiko-Epson	č.	N/A	B/A	N/A	N/A	ŏ
SGS	N	N/A	N/A	N/A	H/A	0
Texas Instruments	ĉ	N/A	N/A	N/A	N/A	Ō
Toshiba	Ñ	10	30	50	100	190
	ç	N/A	N/A	s	s	0
VLSI Technology	č	N/A	N/A	N/A	H/A	ò
WaferScale Integ.	Ċ	N/A	_			0
	N	260	410	525	845	2,040
	С	_30	<u>, 40</u>	_50	_60	200
Total		290	450	575	925	2,240
Percentage Change from						
Previous Quarter		1154	550	284	61%	
Cumulative Total		490	940	1,515	2,440	
ASPs: NNOS		\$75.00	\$45.00	\$35.00	\$28.00	\$39.21
CNOS		\$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
				1984		
		lst	2nd)rd	4th	
		Otr.	Otr.	Qtr.	Otr.	Year
Market Share						
U.S.		86.29	84.41	82.64	78.9%	EL. 99
Japan		13.8	15.6	17.4	21.1	18.1
Burope		0	0	0	0	ű

S = Sampling N/A = Not Available

Table 6 (Continued)
256K MOS EPROM Shipment Data, 1983-1987

•				1985		
	MOS	let	2nd	3zd	4th	••
Company	Process	Otr.	Ote.	Otr.	Otr.	Year
AMD	Ņ	450	800	950	950	3,150
Atmel	N	N/A	N/A	N/A	S	. 0
	С	N/A	N/A	H/A	\$	0
Fujitsu	N	25	200	400	650	1,275
	С	150	250	400	600	1,400
General Instrument	N	N/A	H/A	S	25	25
	¢	N/A	H/A	s	10	10
Hitachi	N	50	200	500	900	1,550
	С	\$	25	150	300	475
Intel	28	1,000	1,800	2,490	2,700	7,900
	c	N/A	s	50	100	150
Mitsubishi	**	5	25	70	600	700
National Semi.	С	S	s	s	10	10
NBC	И	30	230	550	750	1,560
	C	Ş	50	150	200	400
Seeq	C	15	110	180	250	555
Seiko-Epson	С	N/A	N/A	N/A	8	0
SGS	И	H/A	N/A	s	10	10
Tekas Instruments	c	N/A	N/A	- 8	50	\$0
Toshiba	N	150	350	550	700	1,750
	c	150	200	300	425	1,075
VLSI Technology	С	N/A	s	25	50	75
WaferScale Integ.	Ċ	N/A	N/A			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		350%	1094	579	304	
Previous Quarter		3304		•		
Cumulative Total		4,465	8,705	15,380	24,5 6 0	
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 (\$H)		43.7	51.6	37.5	42.5	175.5
				1965		
		lst	2nd	3cd	4th	
		Ott.	Qtr.	Qtr.	Otr.	<u>Year</u>
Market Share						
u.s.		72.39	63.99	54.09	45.21	53.94
Japan		27.7	36.1	46.0	54.7	46.0
Europe		0	0	0	0.1	0
Total		100.00	100.0%	100.09	£00.04	100.01

S = Sampling N/A = Not Available

MOS EPROM—Data

Table 6 (Continued)
256K MOS EPROM Shipment Data, 1983-1987

				1986		
	MOS	lst	2nđ	3rd	4th	
Company	Process	Otr.	Otr.	Otr.	Otr.	<u>Year</u>
AMD -	N	700	1,000	1,050	1,000	3,750
Atmel	N	0	0	0	0	0
	Č	ō	ō	ō	Õ	ō
Fujitsu	N	500	500	500	600	2,100
.,	Č	200	250	250	400	1,100
General Instrument	N	908	600	545	500	2,553
	C	112	317	493	500	1,422
	COTP	35	85	10	200	330
Hitachi	N	950	1,100	1,350	1,500	4,900
	С	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	И	1,637	2,096	1,776	935	6,444
	С	0	0	19	157	176
	N OTP	1,249	1,480	1,435	3,435	7,599
	C OTP	0	0	0	0	Q
National Semi.	C	25	100	250	300	675
NEC	'n	1,230	1,250	990	500	3,970
	С	1,620	1,220	1,140	800	4,780
Oki Electric	N	N/A	S	0	30	30
Ricoh	С	0	0	5	5	10
Seeg	С	70	70	40	40	220
Seiko-Epson	С	0	5	10	10	25
SGS	И	б	136	10	10	162
Signetics	С	S	S	5	15	20
Texas Instrument	С	125	200	225	800	1,350
Toshiba ,	N	600	800	800	800	3,000
	С	300	400	400	400	1,500
	N OTP	300	500	800	1,200	2,800
	C OTP	100	200	200	200	700
VLSI Technology	С	50	50	50	50	200
WaferScale Integ.	C	S	, 5	5	5	15
Others	N	0	0	0	0	0
	c	5	<u>5</u>	5	5	20
	И	11,580	13,712	13,736	14,810	53,838
	С	3,142	3,582	4,207	5,237	16,168
Total		14,722	17,294	17,943	20,047	70,006

Table 6 (Continued)

256K MOS EPROM Shipment Data, 1983–1987

•			1986		
	1st	2nd	3rd	4th	
	Otr.	Otr.	Otr.	Otr.	<u>Year</u>
Percentage Change from					
Previous Quarter	60%	17%	4%	12%	r
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
0verall	\$4.32	\$4.71	\$4.73	\$4.47	\$4.57
Revenue (\$M)	63.7	81.4	85.0	89.7	319.7
		•	1986		
	lst	2nd	3rd	4th	
	<u>Otr.</u>	Otr.	Otr.	Otr.	<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	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.

Table 6 (Continued)
256K MOS EPROM Shipment Data, 1983-1987

				1987			
	MOS	lst	2nđ	3rd	4th		
Company	<u>Process</u>	Otr.	Otr.	Otr.	Otr.	<u>Year</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	
_	С	700	1,700	2,050	2,500	6,950	
Hitachi	N	2,500	2,500	1,500	0	6,500	
	С	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	
•	С	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	
	С	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	
	С	400	500	750	1,050	2,700	
	N OTP	950	450	800	550	2,750	
	C OTP	0	0	50	130	180	
National Semi.	С	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	С	75	75	75	75	300	
Seiko-Epson	С	20	20	20	10	70	
SGS-Thomson	n	836	1,162	1,170	1,600	4,768	
Signetics	С	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	
	С	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	С	25	30	30	50	135	
WaferScale Integ.	С	15	20	20	30	85	
	N	17,761	19,602	17,480	17,075	71,918	
	С	9,234	11,187	14,031	<u>13,555</u>	48,007	
Total		26,995	30,789	31,511	30,630	119,925	

Table 6 (Continued)
256K MOS EPROM Shipment Data, 1983-1987

	1987							
	lst	2nd	3rd	4th				
	<u>Otr.</u>	Otr.	Otr.	Otr.	<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					
	lst	2nd	3rd	4th				
	Otr.	Otr.	Otr.	Otr.	<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	_3.1	3.8	<u>3.7</u>	<u>5.2</u>	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

Table 7
512K MOS EPROM Shipment Data, 1984–1987

	HOS	lst	2nd)rd	4th	_		
Сомрану	Process	Otr.	Qtr.	Otr.	Qtr.	Year		
AMD	N	s	2	2	4	8		
Fujitsu	N	N/A	H/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	Ů.		
	¢	N/A	N/A	N/A	H/A	0		
Intel	N	N/A	5	2	6	8		
Mítsubíshi	N	N/A	N/A	N/A	N/A	0		
<u> Toshiba</u>	N	N/A	N/A	N/A	H/A	0		
	c	N/A	N/A	H/A	N/A	0		
VLSI Technology	C	N/A	N/A	N/A	N/A	0		
WaferScale Integ.	c	N/A	<u>N/A</u>	N/A	<u> N/A</u>	0		
	N	0	2	4	10	16		
	С	0		0	0	_0		
Total		0	2	4	10	16		
Percentage Change from		0	ø	1004	150			
Previous Quarter		U	·	Tone	1204			
Cumulative Total		0	2	6	16			
ASPa: NMOS		\$250.00	\$150.00	\$120.30	\$95.00	\$106.13		
CH06		0	0	0	0	9		
Overall		\$250.00	\$150.00	\$120.00	\$95.00	\$100.13		
Revenue (\$M)		0	0.3	0.5	1.0	1.7		
				1984				
		lst	2nd	3rd	4th			
		Qtr.	Otr.	Qtr.	Otr.	Year		
Market Share								
u.s.		0	100.0%	100.00	100.0%	100.04		
Japan		0	0	0	0	0		
Europe			0	0	0	0		
		a	100.01	100.00	100.0%	100.00		

S = Sampling N/A = Not Available

Table 7 (Continued)
512K MOS EPROM Shipment Data, 1984-1987

				1985		
	MOS	lat	2nd	3rd	4th	
Company	Process	Qtr.	Otr.	Otr.	Otr.	Tear
AMD	N	12	30	35	75	152
Fujitau	N	N/A	H/A	s	10	10
General Instrument	c	H/A	N/A	N/A	N/A	0
Hitachi	N	N/A	N/A	s	15	15
	С	H/A	H/A	N/A	N/A	0
Intel	H	15	50	65	135	265
Mitaubishi	N	N/A	N/A	N/A	N/A	0
Toshiba	N	N/A	N/A	N/A	S	0
	¢	H/A	H/A	N/A	H/A	0
VLSI Technology	C	N/A	H/A	N/A	H/A	0
WaferScale Integ.	С	<u>N/A</u>	H/A	<u>N/A</u>	H/A	0
	N	27	90	100	225	432
	C	0	0	0	10	_10
Total		27	80	100	235	442
Percentage Change from Previous Quarter		1709	196%	25%	1350	
Cumulative Total		43	123	223	458	
ASPs: NHOS		\$80.00	\$50.00	\$30.00	\$22.00	\$32.66
CMOS		0	0	\$45.00	\$25.00	\$25.00
Overail		\$80.00	\$50.00	\$30.00	\$22-13	\$32.49
Revenue (\$M)		2.2	4.0	3.0	5.2	14.4
				1985		
		ist	2nd	3rd	4th	
		Otr.	Otr.	Otc.	Otr.	Year
Market Shase						
v.s.		100.0%	40.001	100.0%	89.40	94.3%
Japan		0	0	0	10.6	5.7
Europe		<u> </u>	0			
Total	-	100.00	100.0%	100.0%	100.0%	100.04

S = Sampling N/A = Not Available

Table 7 (Continued)
512K MOS EPROM Shipment Data, 1984–1987

		_		1986		
	MOS	lst	2nd	3rd	4th	
Company	Process	Otr.	Otr.	Qtr.	Otr.	Year
AND	N	175	280	540	400	1,395
Fujitsu	С	25	25	25	25	100
General Instrument	c	s	01	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
întel	N	250	400	730	900	2,280
Mitsubishi	N	H/A	3	58	365	423
National Semi.	С	N/A	5	0	0	0
Oki Electric	N	N/A	H/A	\$	s	0
Texas Instruments	Ç	N/A	N/A	s	50	50
Toshiba	N	50	150	3 00	400	900
	OTP	N/A	N/A	8	30	30
VLSI Technology	C	S	0	3	5	8
WaferScale Integ.	c	H/A	N/A	N/A	H/A	0
Others	С			5	5	15
	н	475	830	1.688	2,395	5,388
	C	25	40	58	190	313
Total		500	670	1,746	2,585	5,701
Percentage Change from Previous Quarter		1131	748	101%	101	
Cumulative Total		956	1.828	3.574	6,159	
COMUTACIVE IOCAL		736	1,020	3,3/4	4,139	
ASPs: NMOS		\$14.00	\$12.00	\$12.00	\$11.00	\$11.74
CHOS		\$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	26.6	67.6
				1986		
		let	2nd	3rd	456	
•		Otr.	Qtr.	Qtr.	Qtr.	<u>Year</u>
Market Share						
u.s.		85.04	79.91	74.6%	56.79	68.21
Japan		15.0	20.1	25.4	43.3	31.8
Burope		0		0	0	0
Total		100.00	100.0	100.0%	100.00	100.04

S = Sampling N/A = Not Available

Table 7 (Continued)
512K MOS EPROM Shipment Data, 1984-1987

		1987					
	MOS	let	2nd	4th	th		
Company	Process	Ote.	Otr.	Qtr.	Qtr.	Year	
AMD	N	740	785	525	565	2,61	
	С	3	5	25	435	46	
Pujitsu	С	500	1,500	1,800	2,100	5,90	
Hitachi	N	750	800	850	950	3,35	
	С	5	0	0	0		
Intel	H	800	1,200	1,800	2,700	6,50	
Microchip Tech., Inc.	C	100	150	100	100	45	
	OTP	10	10	20	20	6-	
Mitsubishi	N	750	600 û	1,200	1,450	4,20	
National Semi.	c c	0 8/A	S	0	0 1.050	1,05	
NBC Oki Blectric	N	0/0	180	200	400	78	
OK! PISCELIE	N OTP	Û	170	200	650	1,02	
SGS-Thomson	N OIF	N/A	1	50	350	40	
Texas Instruments	C C	100	200	300	400	1,00	
Toshiba	H	550	500	600	700	2,35	
TOBILLDA	N OTP	200	180	180	170	73	
VLSI Technology	c	5	5	5	8	2	
WaferScale Integ.	č	0					
	N	3,790	4,616	5,605	7,935	21,94	
	¢	<u>715</u>	1,870	2,250	4,113	8,94	
Total		4.505	6.486	7,855	12,048	30,89	
Percentage Change from				Tr.			
Previous Quarter		749	44%	214	53 t		
Cumulative Total		10,664	17,150	25,005	37,053		
ASPs: NMOS		\$10.00	\$ 9.00	\$7.78	\$6.80	\$8.07	
CHOS		\$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	
				1987			
		lst	2nd	3rd	4th		
		Otr.	Otr.	Otr.	Qtr.	Year	
Market Share							
U.S.		39.01	36.31	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	

S = Sampling N/A = Not Available

Source: Dataquest April 1988

Table 8
1-Mbit MOS EPROM Shipment Data, 1986-1987

	MOS	TechnoLogy	lst	2nd	3rd	4th	
Company	Process	<u>Features</u>	Otr.	Qtr.	Qtr.	Otr.	Year
AMD	c	x16	1	1	4	6	12
Atmel	C	N/A	0	0	Q	0	0
Pujitsu	C	x8, x16	N/A	S	Ş	1	1
General Instrument	c	π16	N/A	H/A	N/A	N/A	0
Hitachi	c	x8, x16	s	10	30 25	75 30	115 60
Intel	ĸ	x6, x16	S	5 S	25 S	90	0
Motocola	c	N/A	N/A	N/A	N/A	s	ŏ
National Semi.	c	x8, x16	N/A	5	0	ĭ	ĭ
NBC	c c	x16 x16	N/A	N/A	N/A	ŝ	ā
Oki Electric	c	H/A	N/A	R/A	S	s	ŏ
Texas Instruments	c	x8	N/A	S	5	15	20
Toshiba Other	c	N/A	H/A	N/A	<u>s</u>		0
				 s	25	30	60
	И		_	_			
	c		_1	_11	_39	98	149
Total			Į	1,6	64	128	209
Percentage Change fr Previous Quarter Cumulative Total			0	3,100 0 17	3000	100 % 209	
ASPs: NNOS			\$110.00	480 00	450 00	842 00	*4* 50
ASTR: MACS			\$150.00				
Overall			\$150.00				
Revenue (\$M)			0.1	1.2	3.0	7.1	12.2
					1986		
			lst	2nd	3¢d	4ch	
			Qtr.	Otr.	Otr.	Otr.	<u>Year</u>
Market Share							
V.S.			100.04	37.54	45.30	28.10	34.31
Japan			Q	62.5	54.7	71.9	65.7
Europe			0	9		0	0
Total			100.0%	100.04	100.00	100.00	100.00
S = Sampling N/A = Not Available							

Table 8 (Continued)

1-Mbit MOS EPROM Shipment Data, 1986-1987

•					1987		
	MOS	Technology	lst	2nd	3rd	4th	
Company	Process	<u>Features</u>	Otr.	Otr.	Otc.	Otr.	Year
AMD	С	×16	6	10	25	50	91
Pujitsu	С	x8, x16	N/A	5	5	10	15
Hitachi	¢	x8, x16	0	70	150	250	470
Intel	N	x8, x16	50	30	80	150	310
Microchip Tech., Inc.			N/A	N/A	N/A	N/A	0
Mitsubishi	c	×0, ×16	0	5	5	65	75
National Semi.	С	x8, x16	0	0	0	0	0
NEC	¢	xθ	N/A	0	50	300	350
	¢	x16	N/A	0	50	100	150
Oki E le ctric	¢	x8, x16	N/A	N/A	N/A	s	0
SGS-Thomson	c		N/A	N/A	N/A	N/A	0
Texas Instruments	С		0	0	0	٥	0
Toshiba	¢	x8, x16	_20	40	40	_50	<u>150</u>
	Ŋ		50	30	80	150	310
	c		<u> 26</u>	<u>125</u>	<u>325</u>	<u>825</u>	1,301
Total			76	155	405	975	1,611
Percentage Change fro Previous Quarter Cumulative Total) (M		285	1049 440	1619 845	1419	
ASPa: NMOS			\$26.00	\$24.00	\$24.00	\$24.00	\$24.32
CHOS			\$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
					1987		
			lst	2nd	3rd	4th	
			Ote.	Qtr.	Otr.	Otr.	Year
Market Share							
U.S.			73.74	25.8%	25.9%	20.5%	
Japan			26.3	74.2	74.1	79.5	75.1
Entobe			0	0	0	0	0
Total			100.00	100.0%	100.01	100.0%	100.01
S = Sampling N/A = Not Available							

Source: Dataquest April 1986

MOS EPROM—Data

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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.

Table 1

8K MOS EPROM Shipment Data, 1976-1985

			_1976 _		
	lst	2nd	3rđ	4th	
Company	Otr.	Otr.	Otr.	Otr.	<u>Year</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	<u></u> S	_20	<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>		
	lst	2nd	3rd	4th	
	Otr.	Otr.	Otr.	Otr.	<u>Year</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	O	100.0%	100.0%	100.0%	100.0%

N/A ≈ Not Available S = Sampling

Table I (Continued) ... 8K MOS EPROM Shipment Data, 1976–1985

			1977		
	lst	2nd	3rd	4th	
Company	Otr.	Otr.	Otr.	Otr.	<u>Year</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	100	100	200	300	<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
			1977		
	lst	2nd	3rđ	4th	
	Otr.	Otr.	Otr.	Otr.	<u>Year</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	0	0	0	0	0
Total	100.0%	100.0%	100.0%	100.0%	100.0%

N/A = Not Available S = Sampling

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

			1978		
	lst	2nd	3rd	4th	
Company	Otr.	Otr.	Otr.	Otr.	<u>Year</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>	N/A	10	30	40
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
			1978		<u>_</u>
	lst	2nd	3rd	4th	
	Otr.	Otr.	Otr.	Otr.	<u>Year</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	0	0	0	0	0
Total	100.0%	100.0%	100.0%	100.0%	100.0%

N/A = Not Available

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

			1979 _		
	lst	2nd	3rđ	4th	
Company	Otr.	Otr.	Otr.	Otr.	<u>Year</u>
АМО	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	<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
	•		1979 _		
	lst	2nd	3rd	4th	
	Otr.	Otr.	Otr.	Otr.	<u>Year</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

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

	<u> </u>		1980		
	lst	2nd	3rd	4th	
Company	Otr.	Otr.	Otr.	Otr.	<u>Year</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	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
			19 80		
	lst	2nd	3rd	4th	
	Otr.	Otr.	Otr.	Otr.	<u>Year</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	0	0	0	0	0
Total	100.0%	100.0%	100.0%	100.0%	100.0%

N/A = Not Available

S = Sampling

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

			1981		
	lst	2nd	3rd	4th	
Company	<u>Otr.</u>	Otr.	Otr.	Otr.	<u>Year</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	0	0	0	0	0
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
			1981		
	lst	2nd	3rd	4th	
	Otr.	Otr.	Otr.	Otr.	<u>Year</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	0	0	0	0	0
Total	100.0%	100.0%	100.0%	100.0%	100.0%

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

			1982_		
	lst	2nd	3rd	4th	
<u>Company</u>	Otr.	Otr.	Otr.	Otr.	<u>Year</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	0	0	0	0	0
Total	645	430	480	300	1,855
Percentage Change from	(275)	(226)	124	(200)	
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
			1982	·.	
	lst	2nd	3rđ	4th	
	Otr.	Otr.	Otr.	Otr.	<u>Year</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	0	0	0	0	0
Total	100.0%	100.0%	100.0%	100.0%	100.0%

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

			1983		
	lst	2nd	3rd	4th	
Company	Otr.	Otr.	Otr.	Qtr.	<u>Year</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	0	0	0	0	0
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
			1983		
	lst	2nd	3rd	4th	
	Otr.	Otr.	Otr.	Otr.	<u>Year</u>
Market Share					
ប.ន.	100.0%	100.0%	100.0%	100.0%	100.0%
Japan	0	0	0	0	Q
Europe	0	0	0	0	0
Total	100.0%	100.0%	100.0%	100.0%	100.0%

MOS EPROM—Data

Table 1 (Continued)

8K MOS EPROM Shipment Data, 1976–1985

		<u></u>	1984		
	lst	2nd	3rd	4th	
<u>Company</u>	Otr.	Otr.	Otr.	Otr.	<u>Year</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	3	0	0	25
Oki Electric	0	0	0	0	0
Texas Instruments	0	0	0	0	0
Toshiba	0	0	0	0	0
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
			1984		
	lst	2nd	3rd	4th	
	Qtr.	Otr.	Otr.	Otr.	<u>Year</u>
Market Share					
U.S.	100.0%	100.0%	100.0%	100.0%	100.0%
Japan	0	Q	0	0	0
Europe	0	0	0	0	0
Total	100.0%	100.0%	100.0%	100.0%	100.0%

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

			1985		
	lst	2nd	3rd	4th	
Company	Otr.	Otr.	Otr.	Otr.	<u>Year</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	G	0	0	0
Texas Instruments	. 0	0	0	0	0
Toshiba	0	0	0	0	0
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
			1985		
	lst	2nd	3rd	4th	
	Otr.	Otr.	Otr.	Otr.	<u>Year</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	<u>0</u>
Total	100.0%	100.0%	100.0%	100.0%	100.0%

Source: Dataquest

April 1988

Table 2

16K MOS EPROM Shipment Data, 1976–1987

				1976		
	MOS	İst	2nd	3rd	4th	
Company	Process	Otr.	Otr.	Otr.	Otr.	<u>Year</u>
AMD .	N	N/A	N/A	N/A	N/A	N/A
Eurotechnique	С	N/A	N/A	N/A	N/A	N/A
Fairchild	N	N/A	N/A	N/A	N/A	N/A
Pujitsu	M	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	5	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	H/A	N/A	N/A	N/A	N/A
Oki Electric	N	N/A	N/A	H/A	N/A	N/A
SGS-Ates	N	N/A	N/A	N/A	H/A	N/A
Synectek	N	N/A	N/A	H/A	N/A	N/A
Texas Instruments	N	N/A	N/A	N/A	5	5
Toshiba	N	N/A	<u>N/A</u>	H/A	H/A	N/A
	N	0	0	0	15	15
	c				0	0
Total		0	0	0	15	15
Percentage Change from						
Percentage Change from Previous Quarter				•		
		0	0	,	15	
Previous Quarter Cumulative Total ASPa: HMOS		0 \$50.00	0 \$50.40		15 \$50.00	\$50.00
Previous Quarter Cumulative Total ASPa: NeOS CMOS				0		
Previous Quarter Cumulative Total ASPa: HMCS		\$50.00	\$50.00	\$50.00	\$50.00	0
Previous Quarter Cumulative Total ASPa: NeOS CMOS		\$50.QQ 0	\$50.00 0	\$50.00 0	\$50.00 0	\$50.00
Previous Quarter Cumulative Total ASPa: HMOS CMOS Overall		\$50.00 0 \$50.00	\$50.00 0 \$50.00	\$50.00 0 \$50.00	\$50.00 0 \$50.00	\$50.00
Previous Quarter Cumulative Total ASPa: HMOS CMOS Overall		\$50.00 0 \$50.00	\$50.00 0 \$50.00	\$50.00 0 \$50.00	\$50.00 0 \$50.00	\$50.00
Previous Quarter Cumulative Total ASPa: HMOS CMOS Overall		\$50.00 0 \$50.00	\$50.00 0 \$50.00	\$50.00 \$50.00 0	\$50.00 0 \$50.00	\$50.00
Previous Quarter Cumulative Total ASPa: NMOS CMOS Overall Revenue (\$M)		\$50.00 0 \$50.00 0	\$50.00 0 \$50.00 0	\$50.00 0 \$50.00 0	\$50.00 0 \$50.00 0.8	0 \$59.00 0.8
Previous Quarter Cumulative Total ASPa: MMOS CMOS Overall Revenue (\$M) Market Share U.S.		\$50.00 0 \$50.00 0	\$50.00 0 \$50.00 0	\$50.00 0 \$50.00 0	\$50.00 0 \$50.00 0.8	0 \$59.00 0.8
Previous Quarter Cumulative Total ASPa: NMOS CMOS Overall Ravenue (\$M)		\$50.00 0 \$50.00 0	\$50.00 0 \$50.00 0	\$50.00 0 \$50.00 0 1976 3rd Qtr.	\$50.00 0 \$50.00 0.8 4th Qtr.	0 \$50.00 0.8
Previous Quarter Cumulative Total ASPa: MMOS CMOS Overall Revenue (\$M) Market Share U.S.		\$50.00 0 \$50.00 0	\$50.00 0 \$50.00 0	\$50.00 0 \$50.00 0 1976 3rd 0tr.	\$50.00 0 \$50.00 0.8 4th Qtr.	100.01

S = Sampling N/A = Not Available

Table 2 (Continued)

16K MOS EPROM Shipment Data, 1976–1987

		1977					
	MOS	lst	2nd	3rd	4th		
Company	Process	Otr.	Qtr.	Otr.	Otr.	<u>Year</u>	
AMD	N	B/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	
Pujitsu	N	N/A	N/A	N/A	N/A	N/A	
Hítachi	н	H/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	н	N/A	N/A	N/A	N/A	N/A	
Motorola	N	H/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	M	H/A	H/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	<u> </u>	<u>H/A</u>	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	679	309	384		
Cumulative Total		75	175	305	485		
ASPs: NMOS		\$45.00	\$45.00	\$30.00	\$30.00	\$35.11	
Overail		0 \$4 5.00	0 \$45,00	\$30.00	\$30.00	\$35.11	
Revenue (SM)		2.7	4.5	3.9	5.4	16.5	
				1077			
		lst	2nd	<u>1977</u> 3rd	4th		
		<u>otr.</u>	Ott.	Otr.	Qtr.	Year	
Market Share							
U.S.		100.0%	100.0%	100.01	100.04	100.04	
Japau		0	0	0	0	0	
Europe		0	0	0		0	
Total		100.0%	100.00	100.0%	100.04	100.0%	

N/A - Not Available

Table 2 (Continued)

16K MOS EPROM Shipment Data, 1976–1987

				1978		
	MOS	lst	2nd	3rd	4th	
Сомрану	Process	Otc.	Qtr.	Qtr.	<u>Qtr.</u>	Year
AMD	N	N/A	N/A	N/A	N/A	0
Eurotechnique	¢	N/A	N/A	N/A	N/A	0
Fairchild	Н	N/A	N/A	N/A	N/A	0
Fujitsu	H	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	(
Mitsubishi	N	N/A	N/A	N/A	N/A	(
Mostek	N	S	s	s	25	2
Motorola	H	N/A	S	10	90	100
National Semi.	N	N/A	N/A	s	s	
	C	N/A	N/A	N/A	N/A	(
NEC	N	N/A	N/A	N/A	N/A	(
Oki Blectric	N	N/A	N/A	N/A	N/A	(
SGS-Ates	N	N/A	N/A	N/A	N/A	•
Synertek	N	N/A	N/A	N/A	N/A	(
Texas Instruments	N	100	250	200	300	850
<u>Toshiba</u>	И	<u>N/A</u>	N/A	_ <u>_s</u>	5	
	N	350	650	465	905	2,376
	c	0	0	0	0	
Total		350	650	465	905	2,370
Percentage Change from Previous Quarter		944	861	(28%)	95%	
Cumulative Total		835	1,485	1,950	2,855	
ASPs: NMOS CMOS		\$28.00 0	\$25.00	\$25.00 0	\$15.00 0	\$21.62
		\$28.00	\$25.00	-	\$15.00	\$21.62
Overall		320.00	323.00	\$25.00	413.00	\$21.0
		9.8	16.3	11.6	13.6	
Overall		9.8	16.3	11.6	13.6	
Overall		9.8	16.3 2nd	11.6 	13.6 4th	51.
Overall		9.8	16.3	11.6	13.6	
Overall Revenue (\$M) Market Share		9.8 Lat Otr.	2nd Qtr.	11.6 	13.6 4th Otr.	Year
Overall		9.8	16.3 2nd	11.6 	13.6 4th	Year
Overall Revenue (\$M) Market Share		9.8 Lat Otr.	2nd Qtr.	11.6 	13.6 4th Otr.	Year
Overall Revenue (\$M) Market Share U.S.		9.8 Lst Otr.	2nd Qtr. 100.08	11.6 	13.6 4th <u>Otr.</u> 95.6%	51.3 Year 98.13

S = Sampling N/A = Not Available

Table 2 (Continued)

16K MOS EPROM Shipment Data, 1976–1987

		1979					
	MOS	lst	2nd	3rd	4th		
Company	Process	Otr.	Otr.	Otr.	Otr.	<u> Year</u>	
AMD	и	N/A	s	5	10	15	
Eurotechnique	c	N/A	N/A	N/A	N/A	Q	
Fairchild	N	N/A	N/A	N/A	N/A	Q	
Fujitsu	И	70	200	300	300	870	
Hitachi	N	125	200	350	500	1,175	
Intel	N	550	750	800	900	3,000	
Matsushita	N	H/A	N/A	N/A	N/A	0	
Mitaubishi	N	10	20	50	90	170	
Mostek	N	90	150	250	350	840	
Motorola	H	160	150	160	200	670	
National Semi.	H	5	50	80	120	255	
	C	H/A	N/A	H/A	N/A	0	
NBC	n	N/A	N/A	N/A	5	5	
Oki Electric	H	N/A	N/A	N/A	N/A	Ó	
SGS-Ates	N	N/A	N/A	N/A	N/A	Q	
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	
	¢	0	0	0	0	0	
Total		1,435	2,470	3,165	4,475	11,565	
Percentage Change from Previous Quarter		594	721	291	411	•	
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	9	
Overall		\$17.00	\$22.00	\$19.00	\$17.00	\$18.62	
Revenue (\$M)		24.4	54.3	60.5	76.1	215.3	
				1979			
		lst	2nd	3rd	4th		
		Otr.	Qtr.	Otr.	Otr.	Year	
Market Share		•					
		84.0%	81.0%	75.2%	75.5%	77.6%	
U.S.						22.4	
U.S. Japan		16.0	19.0	24.8	24.5	22.4	
		16.0 0	19.0	24.8	0	0	

S ≠ Sampling N/A ≈ Not Available

Table 2 (Continued)

16K MOS EPROM Shipment Data, 1976–1987

				1980		
	MOS	Lst	2nd	3rd	4th	
Company	Process	Otr.	Otc.	Otr.	Otr.	Year
AMD	N	25	50	100	175	350
Eurotechnique	c	N/A	N/A	N/A	N/A	a
Fairchild	N	30	300	300	250	880
Pujitsu	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	И	10	25	50	125	210
Oki Blectric	И	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	0,100
Toshiba	H	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		644	(12%)	191	139	
Cumulative Total		21,770	28,260	35,965	44,710	
ASPs: 1940S		\$15.00	\$11.00	\$8.00	\$6.00	\$9.76
CH06		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
				1980		
		lst	2nd	3rd	4th	
		Otr.	Qtr.	Qtr.	Qtr.	Year
Market Share						
U.S.		54.19	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		100.09	100.0%	100.0%	100.0%	100.0%

S = Sampling N/A = Not Available

Table 2 (Continued)

16K MOS EPROM Shipment Data, 1976–1987

		1981					
	MOS	lst	2nd	3rd	4th		
Company	Process	Qtr.	Otr.	Qtr.	Otr.	Year	
AMD	N	250	350	485	750	1,835	
Burotechnique	c	N/A	N/A	s	15	15	
Fairchild	N	100	20	20	0	140	
Fujit su	Hr ,	750	1,000	700	500	2,950	
Hitachi	N	1,700	1,700	1,200	700	5,300	
Intel	Ж	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	H	700	600	700	800	2,800	
Motorola	N	400	420	500	400	1,720	
National Semi.	H	500	550	700	1,100	2,850	
	¢	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	ы	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	700	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		179	129	asi	34	-	
Cumulative Total		54,915	66,360	77,665	89,325		
ASPs: NMOS		\$4.50	\$3.50	\$3.00	\$2.50	\$3.34	
CMOS		0	Q	0	0	0	
Overall		\$4.50	\$3.50	\$3.00	\$2.50	\$3.34	
Revenue (SN)		45.9	40.1	33.9	29.1	149.0	
				1981			
		lst	2nd	3rd	4th		
		Qtr.	Qtr.	Otr.	Otr.	Year	
Market Share							
U.S.		66.18	65.0%	67.3%	70.8%	67.31	
Japan		33.7	34.8	32.3	28.5	32.3	
Europe		0.1	0.2	0.4	0.8	0.4	
Total		100.00	100.00	100.0%	100.0%	100.04	

S = Sampling N/A = Not Available

Table 2 (Continued)

16K MOS EPROM Shipment Data, 1976–1987

		1982				
	MOS	lst	2nd	3rd	4th	
Сопрапу	Process	Otr.	Otr.	Otr.	Qtr.	Year
AMD	N	1,000	1,150	1,150	900	4,200
Eurotechnique	С	100	400	500	600	1,600
Fairchild	N	0	0	0	0	0
Pujitsu	N	400	350	250	100	1,100
Ritachi	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
Nostek	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
	С	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	Ò	-,,0
Texas Instruments	N N	2,000	2,000	1,800	1,800	7,500
Toshiba	N.	500	400	300	_ 300	1,500
2001120	••		100			17300
	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 (rom	1			,		
Previous Quarter		(2%)	(4%)	(71)	(14)	
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
				1982		
		lst	2nd	3rd	4th	
		Qtr.	Otr.	Otr.	Otr.	<u>Year</u>
Market Share						
U.S.		70.2%	67.44	64.48	64.9%	66.8%
Japan		28.1	27.3	27.3	24.1	26.8
Europe		1.8	5.3	<u> </u>	11.0	6.4
Total		100.0%	100.0%	100.00	100.0%	100.0%

Table 2 (Continued)

16K MOS EPROM Shipment Data, 1976–1987

				1983		
_	MOS	ist	2nd	3zd	4th	
Company	Process	Qtr.	Otr.	Otr.	Otr.	<u>Year</u>
AMD	N	700	700	1,000	1,200	3,600
Burotechnique	С	200	200	200	200	800
Pairchild	н	0	0	0	0	0
Pujitsu	N	50	50	0	0	100
Hitachi	N	1.00	100	50	0	250
Intel	N	1,000	1,000	800	700	3,500
Matsushita	N	T00	100	100	100	400
Mitsubishi	N	180	120	160	130	590
Mostek	H	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
	С	350	500	500	700	2,050
NBC	N	2,000	2,500	2,700	1,500	8,700
Oki Electric	И	400	400	350	350	1,500
SGS-Ates	N	500	800	800	900	3,000
Synertek	N	0	0	0	0	Q
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
	¢	550	700	700	900	2,650
Total		10,180	11,800	12,440	11,730	46,150
Percentage Change from		***		2.		
Previous Quarter		100	169	54	(64)	
Cumulative Total		142,335	154,135	166,575	178,305	
ASPS: NMOS		\$3.00	\$3.15	\$3.25	\$3.35	\$3.19
C1408		0	. 0	Q	0	
Overall		\$3.00	\$3.15	\$3.25	\$3.35	\$3.19
Revenue (\$M)		28.9	35.0	38.2	36.3	136.3
				1983		
		lst	2nd	3rd	4th	
		Otr.	Qtr.	<u>Qtr.</u>	Otr.	<u>Year</u>
Market Share						
U.S.		63.4%	63.0%	64.18	72.04	65.70
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%	100.01	100.0%	100.00	100.00

Table 2 (Continued)

16K MOS EPROM Shipment Data, 1976–1987

				1984		
	MQS	lst	2nd	3rd	4th	
Company	Process	Otr.	Ote.	Qtr.	Otr.	<u>Year</u>
AMD	N	1,000	1,100	1,200	1,300	4,600
Fairchild	N	0	0	0	0	0
Pujitsu	N	0	0	0	0	0
Hitachi	И	0	0	0	0	0
Intel	N	300	150	100	50	600
Matsushita	N	50	50	25	0	125
Mitsubisni	H	130	130	130	100	490
Mostek	N	0	0	Q.	0	0
Motorola	N	0	0	0	0	0
National Semi.	N	2,600	2,700	2,400	2,000	9,900
NEC	C N	700 1,350	700	550	400 700	2,350 4,200
Oki Blectric			1,200	950	200	•
	N	250	250	200		900
SGS	N	1,050	600	300	800	2,750
Synertek	N		0	0		
Texas Instruments	N	3,500	3,000	2,000	1,800	10,300
Thomson-Eurotechnique	Ç	200	250	250	250	950
Toshiba	N	0	0	0	0	0
	N	10,430	9,180	7,305	6,950	33,865
	С	900	950	800	650	3,300
Total		11,330	10,130	8,105	7,600	37,165
Percentage Change from						
Previous Quarter		(3%)	(114)	(20%)	(68)	
Cumulative Total		189,635	199,765	207,870	215,470	
ASPS: NMOS		\$3.35	\$3.35	\$3.0Ó	\$2.85	\$3.17
CNOS		\$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		
		lst	2nd	3rd	4th	
		Otr.	Otr.	Otr.	Otr.	Year
Market Share						
U.S.		73.30	75.5%	77.1%	73.00	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		\$0.001	100.0	100.0%	100.0%	100.0%
					1	•

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

				1985		
	MOS	lst	2nd	3rd	4th	
Сопрапу	Process	Qtr.	Qtr.	Otr.	Otr.	Year
AMD	N	1,550	1,850	1,350	1,050	5,800
Fairchild	M	. 0	· o	Q	0	0
Fujitsu	N	0	0	0	0	0
Hitachi	N	0	0	0	0	0
Intel	N	0	Û	0	0	0
Matsushita	N	0	0	Ů.	0	0
Mitsubishi	N	50	50	0	0	100
Mostek	N	O	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
NBC .	N	400	250	900	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	Q
Texas Instruments	N	1,500	1,500	1,600	1,600	6,200
Thomson-Eurotechnique	C	350	450	400	500	1,700
Toshiba	N	<u>0</u>	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		(98)	19	49	(111)	
Cumulative Total		222,420	229,420	236,670	243,090	
ASPs: NMOS		\$2.60	\$2.40	\$2.25	\$2.25	\$2.38
CHOS		\$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
				1985		
		lst	2nd	3r d	4th	
		Otr.	Otr.	Qtr.	Qtr.	Year
Market Share						
v.s.		75.58	75.7%	66.9%	67.8%	71.50
Jabau		8.6	6.4	12.4	5.8	8.4
Europe		15.8	17.9	20.7	<u>_26.5</u>	20.1
Total		199.00	100.04	100.00	100.0%	#0.001

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

		1986					
	MOS	lst	2nd	314	4th		
Company	Process	Qtr.	Otr.	Otr.	Otr.	Year	
AMO	N	1,000	600	450	375	2,425	
Intel	N	250	250	250	250	1,000	
National Semi.	И	1,500	1,200	950	800	4,450	
NEC	19	180	220	80	40	520	
SGS	N	356	189	600	406	1,545	
Texas Instruments	N	750	750	400	200	2,100	
Thomson	N	1,000	600	<u>600</u>	425	2,625	
	N	5,036	3,809	3,330	2,490	14,665	
	С	0	0	0	0	0	
Total		5,036	3,809	3,330	2,490	14,665	
Percentage Change from Previous Quarter		(22%)	(24%)	(134)	(25%)		
Cumulative Total		248,126	251,935	255,265	257,755		
ASPs: NMOS		\$2.35	\$2.40	\$2.40	\$2.50	\$2.40	
CM0S		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			
		Let	2nd	3rd	4th		
		Otr.	Otr.	Otr.	Qtr.	Year	
Market Share							
v.s.		69.5%	73.5%	61.6%	65.34	68.0%	
Japan		3.6	5.6	2.4	1.6	3.5	
Europe		26.9	20.7	36.0	33.1	<u> 28.4</u>	
Total		100.04	100.00	100.0%	100.00	100.0%	

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

	MOS	lst	2nd	3ed	4th		
Company	Process	Otr.	Otr.	Otr.	Qtr,	<u>Year</u>	
AMD	M	500	350	300	350	1,500	
Cypress	С	150	200	200	350	900	
Intel	N	200	200	200	200	800	
National Semi.	c	158	227	204	195	784	
NEC	M	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	<u> 75</u>	<u>75</u>	185	
	N	2,135	1,915	1,940	1,450	7,440	
	¢	383	572	619	820	2,394	
Total		2.518	2,487	2,559	2,270	9,834	
Percentage Change from Previous Quarter		18	(19)	38	(118)		
•							
Cumulative Total		260,273	262,760	265,319	267,589		
ASPs: NMOS		\$2.55	\$2.60	\$2.65	\$2.70	\$2.62	
CHOS		\$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			
		ist	2nd	3rd	4th		
		Otr.	Otr.	Otr.	Otr.	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	
Entobe		48.1	48.0	49.6	35.0	45.5	
Total		100.00	100.0%	100.00	100.0%	100.0%	

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

Source: Dataquest April 1986

Table 3

32K MOS EPROM Shipment Data, 1978–1987

		1978					
	MOS	lst	2nd	3ed	4th		
Company	Process	Otr.	Otr.	Otr.	Otr.	Year	
AMD	N	N/A	N/A	N/A	N/A	0	
Eurotechnique	¢	N/A	N/A	N/A	N/A	٥	
Pujitsu	N	N/A	N/A	N/A	N/A	0	
-	Ç	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	H/A	N/A	N/A	N/A	0	
Motorola	N	N/A	N/A	N/A	N/A	0	
National Semi.	c	N/A	H/A	H/A	N/A	0	
NEC	H	N/A	N/A	N/A	N/A	Q.	
Ricon	c	N/A	N/A	N/A	H/A	0	
Rockwell	N	H/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	H/A	N/A	5	5	
Coshiba	N	N/A	<u>M/A</u>	<u>H/A</u>	N/A	0	
	N	0	0	0	5	5	
	C	<u>o</u>	<u>o</u> , .	<u>o</u>	<u>0</u>		
Total		•	Ö	0	5	5	
Percentage Change fro Previous Quarter	Om	o	a	0	o		
LIAATORS Address		•	•				
Cumulative Total		0	٥	0	5		
ASPs: NMOS		0	0	0	0	\$80.00	
CMOS		O	0	0	0		
Overall		0	o	0	0	\$80.00	
Revenue (\$M)		0	0	0	Q	C	
				1978			
		let	2nd	3rd	4th	-	
		Otr.	Otr.	Qtr.	<u>Qtr.</u>	Year	
Market Share							
v.s.		0	0	0	0	0	
Japan		0	0	Q	0	0	
Europ e		0	0	<u>o</u>	<u>o</u>	0	

S = Sampling N/A = Not Available

Table 3 (Continued)

32K MOS EPROM Shipment Data, 1978–1987

				1979		
•	MOS	lst	2nd	Эrd	4th	
Company	Process	Otr.	Otr.	Otr.	Otr.	<u>Year</u>
АИО	N	N/A	N/A	N/A	N/A	٥
Burotechnique	С	N/A	N/A	N/A	N/A	O
Pujitsu	N	N/A	N/A	N/A	s	0
	Ç	N/A	N/A	N/A	N/A	0
Hitachi	ы	H/A	N/A	N/A	S	0
Intel	N	5	30	50	100	185
Mitsubishi	N	H/A	N/A	N/A	Ş	0
Motorola	N	N/A	N/A	N/A	5	0
National Semi.	c	N/A	N/A	N/A	N/A	0
NBC	N	H/A	N/A	N/A	N/A	0
Ricoh	c	H/A	N/A	N/A	N/A	Ů.
Rockwell	N	H/A	N/A	N/A	N/A	0
	¢	N/A	H/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	<u>N/A</u>	N/A	<u>N/A</u>	0
	N	15	65	110	190	380
	С		0	0	0	0
Total		15	65	110	190	380
Percentage Change from						
Previous Quarter		0	333%	691	73%	-
Cumulative Total		20	85	195	385	
ASPs: NHOS		\$80.00	\$80.00	\$75.00	\$75.00	\$76.05
CMOS		0	•	0	. 0	D.
Overall		\$60.00	\$80.00	\$75.00	\$75.00	\$76.05
Revenue (SH)		1.2	5.2	0.3	14.3	28.9 .
				1979		
		lst	2nd	3 e d	4th	
		otr.	Qtr.	Qtr.	Qtr.	Year
Market Share						
U.S.		100.0%	100.0%	100.0%	100.04	100.0%
Japan		0	0	0	0	0
Europe		. 0	o		ŏ	ō
Total		100.0%	100.0%	100.0%	100.0%	100.0%

S = Sampling N/A = Not Available

Table 3 (Continued)

32K MOS EPROM Shipment Data, 1978–1987

						
	MOS	lst	2nd			
Company	Process	Otr.	Otr.	Otr.	15 15 1,035 1,462 458 418 2,456 3,918 90.00 \$10.00	Year
AMD	N	H/A	N/A	-	-	2
Eurotechnique	С	N/A	N/A			0
Pujitsu	М	S	ş			115
	C	N/A	H/A			0
Hitachi	И	S	120		280	620
Intel	M	165	250	325	450	1,190
Mitsubishi	N	S	6	40	90	136
Motorola	H	5	30	60	50	145
National Semí.	C	\$	10	15	15	40
NEC	N	N/A	N/A		15	20
Ricoh	c	N/A	N/A			0
Rockwell	И	N/A	N/A			0
	c	n/A	N/A	,	-	9
SGS-Ates	N	N/A	N/A	N/A	N/A	Q.
Texas Instruments	N	150	300	350	450	1,250
Toshiba	N	N/A	<u> </u>	5		15
	N	320	706	1,020	1,447	3,493
	С	0	<u>10</u>	15	15	40
Total		320	716	1,035	1,462	3,533
Percentage Change from Previous Quarter		68%	124%	454	419	
Cumulative Total		705	1,421	2,456	3,918	
ASPs: NMOS		\$55.00	\$40.00	\$30.00	\$10.00	\$26.03
CMOS		0	٥	0	0	0
Overall		\$55.00	\$40.00	\$30.00	\$10.00	\$26.03
Revenue (SM)		17.6	28.2	30.6	14.5	90.9
				1980		
		let	2nd	3rd	4th	
		Otr.	Qtg.	Otr.	Otr.	Year
Market Share						
U.S.		100.00	92.4%	72.5%	66.13	74.43
Japan		0	17.6	27.5	33.9	25.6
Zurope		0	0	0		0
Horobe						

S = Sampling N/A = Not Available

Table 3 (Continued)

32K MOS EPROM Shipment Data, 1978–1987

		1961						
	MOS	lst	2nd	3rd	4th			
Company	Process	Otr.	Qtr.	Qec.	Otr.	Year		
AMD	ы	10	100	120	310	540		
Eurotechnique	С	N/A	N/A	s	5	5		
Pujitsu	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	1,20	250	350	770		
National Semi.	С	10	20	30	30	90		
NEC	N	30	50	325	700	1,105		
Ricoh	¢	N/A	N/A	N/A	N/A	0		
Rockwell	H	N/A	H/A	N/A	N/A	0		
	С	N/A	N/A	N/A	N/A	0		
SGS-Atem	N	N/A	N/A	N/A	N/A	0		
Texas Instruments	Н	360	700	900	1,000	3,160		
Toshiba	H	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		441	31%	65%	510			
_	•					•		
Cumulative Total		6,028	8,783	13,328	20,213			
ASPs: NHOS		\$9.00	\$8.00	\$7.00	\$5.80	\$6.92		
CNOS		0	0	0	0	0		
Overall		49.00	\$8.00	\$7.00	\$5.80	\$6.92		
Revenue (\$M)		18.9	21.9	31.6	39.7	112.1		
				1981				
		lst	2nd	3rd	4th			
		Otr.	Ote.	Qtr.	Otr.	Year		
Market Share								
U.S.		58.3%	59.5%	51.70	47.8%	52.20		
Japan		41.7	40.5	48.3	52.1	47.7		
Europe		0	0	0	0	0		
•								
Total		100.0%	100.0%	100.0%	100.00	100.0#		

S = Sampling N/A = Not Available

Table 3 (Continued)

32K MOS EPROM Shipment Data, 1978–1987

	H08	lst	2nd	3rd	4th	
Company	Process	Otr.	Qtr.	Otr.	Otr.	<u>Year</u>
AMD	N	600	1,050	650	850	3,150
Eurotechnique	С	30	100	150	200	480
Pujitsu	N	600	700	1,800	1,200	3,500
	С	N/A	N/A	N/A	S	0
Hitachi	H	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
Motocola	N	325	100	100	0	525
National Semi.	С	75	100	220	250	645
NEC	N	1,300	1,600	2,200	2,300	7,400
Ricon	C	N/A	N/A	N/A	H/A	0
Rockwell	N	N/A	N/A	N/A	N/A	0
	С	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
	С	105	200	<u>370</u>	450	1,125
Total		0,680	11,160	12,445	12,850	45,135
Percentage Change from						
Previous Quarter		269	294	121	34	
Cumulative Total		28,893	40,053	52,49 8	65,348	
ASPs: NMOS		\$6.00	\$5.50	\$5.00	\$4.75	85.25
CNOS		0	0	0	0	a
Overall		\$6.00	\$5.50	\$5.00	\$4.75	\$5.25
Révenue (\$M)		51.5	60.3	60.4	58.9	231.0
			_	1982		
		lst	2nd	3r d	4th	
		Otr.	Otr.	Otr.	Otr.	Year
Market Share						
U.S.		40.34	39.0%	33.54	35.0%	36.64
Japan		59.3	60.0	65.1	63.0	62-1
Europe		0.3	1.0	1.4	1.9	<u> </u>
Total		100.03	100.00	100.0%	100.00	100.00

S = Sampling N/A = Not Available

Table 3 (Continued)

32K MOS EPROM Shipment Data, 1978–1987

				1983		
	MOS	lst	2nd	3rd	467	
Company	Process	Otr.	Otr.	Otr.	Otr.	Year
AMD	N	800	1,000	1,200	1,500	4,50
Eurotechnique	С	200	300	400	400	1,30
Pujitsu	N	1,200	1,500	1,500	1,500	5,70
	С	10	25	50	50	13
Hitachi	н	3,000	3,500	3,500	3,000	13,00
Intel	N	2,500	2,500	2,200	1,800	9,00
Micsubishi	N	1,600	1,700	1,500	1,300	6,10
Motorola	N	0	0	. 0	0	
National Semi.	¢	350	450	600	800	2,20
MEC	N	2,400	2,500	1,700	1,700	8,30
Ricoh	c :	N/A	N/A	N/A	S	
Hockwell	N	N/A	N/A	N/X	N/A	•
SSS-14-5	C Ni	N/A	N/A	. S	25	2
SGS-Ates	N	50	100	100	100	35 9,50
Texas Instruments	N	1,000 600	2,000 400	3,000 500	3,500 50 0	
Toshiba	N	800	400	500	500	2,00
	н	13,150	15,200	15,200	14,900	58,45
	¢	560	775	1,050	1,275	3,66
Total		13,710	15,975	16,250	16,175	62,11
Percentage Change from						
Previous Quarter		74	17\$	21	0\$	
Cumulative Total		79,058	95,033	111,283	127,458	
ASPs: NMOS		\$4.50	\$4.00	\$3.75	\$3.75	\$3.9
CMOS		0 '	0	0	0	
Overall		\$4.50	\$4,00	\$3.75	\$3.75	\$3.9
Revenue (\$M)		59.2	60.8	57.0	55.9	232.
				1983		
).at	2nd	3rd	4th	
		Qtr.	Qtr.	oer.	Qtr.	Year
Market Share						
U.S.		33.9%	37.2%	43,1%	47.19	40.61
Japan		64.3	60.3	53.8	49.8	56.7
Europe		1.8	2.5	<u> 3.1</u>	3.1	2,7
Total						

5 = Sampling N/A = Not Available

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

				1984		
	MOS	lst	2nd	3rd	4th	
Company	Process	Qtr.	Otr.	Otr.	Otr.	Year
AMD	N	1,600	1,800	2,200	2,200	7,800
Pujitsu	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	ĸ	1,100	900	650	400	3,050
Motorola	N	0	0	0	0	0
National Semi.	С	900	T'000	1,100	850	3,850
NEC	N	1,400	1,550	1,000	750	4,700
Ricoh	C	S	S	\$0	100	150
Rockwell	N	N/A	N/A	S	S	Ó
	¢	50	25	0	G	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
	¢	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%)	13	(104)	(148)	
ridatone American		,,,,,		1200)	(444)	
Cumulative Total		143,208	159,133	173,533	185,958	
ASPs: NMOS		\$3.60	\$3.50	\$3.25	\$3.10	\$3.38
CNOS		\$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
				L <u>984</u>		
		lst	2nd	3¢d	4th	_
		Otr.	Otr.	Otr.	Otr.	Year
Market Share						
U.S.		51.7%	54.20	59.04	58.4%	55.64
Japan		44.8	41.8	34.7	31.6	38.7
Europe		3,5	<u>4.1</u>	<u>6.3</u>	10.1	5.7
Total		100.00	100.0	100.0%	100.01	100.0

S = Sampling N/A = Not Available

(Continued)

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

	MOS	lst	2nd	3rd	4th	
Company	N 2,200 2,450 1,750 1,300	Year				
AMD	N	2,200	2,450			7,700
Pujit su	N	800	600			1,950
•	С					900
Hitachi	N	900				2,400
Intel						6,300
Mitsubishi						2,400
Motorola		_	-	_	_	0
National Semi.						2,300
NBC						2,560
Ricoh						700
Rockwell		-	-	-		100
	_		_	-	-	0
SGS						3,350
Texas Instruments						6,100
						1,550
Toshiba	N		<u>°</u>	<u> </u>	0	9
						32,860
	¢	1,450	1,450	1,350	1,200	5,450
Total		11,180	10,550	8,900	7,680	38,310
Percentage Change from		(108)	(681	(168)	(148)	
Ateatons Onstrat		(104)	(94)	(104)	(144)	
Cumulative Total		197,138	207,688	216,588	224,268	
						\$2.39
						\$4.14
Overall		\$3.15	82.56	\$2.40	\$2.29	\$2.64
Revenue (\$80)		35.2	27.0	21.3	17.6	101.2
				1985		
		let	2nd	3rd	4th	•
		Otr.	Qtr.	Otr.	Otr.	Year
Market Share						
U.S.					58.6%	58.78
Japan			30.8	27.0	23.2	28.5
Europe		10.3	10.4	14.0	10.2	12.8
Total		100.0%	100.00	100.0%	100.0%	100.0%

Table 3 (Continued)

32K MOS EPROM Shipment Data, 1978–1987

				1986		
	MOS	lst	2nd	3rd	4th	
Company	Process	Otr.	Otr.	Otr.	Otr.	Year
AMD	N	950	850	675	450	2,925
Pujitsu	N	150	50	0	0	500
-	C	50	0	0	0	50
Hitachi	N	500	200	100	50	850
Intel	Я	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
NBC	H	330	270	150	100	850
Ricoh	C N	50 463	50 350	9 1,200	0 1.200	100 3,213
963	N N	1,000	1,000	1,100	1,500	4,600
Texas Instruments Thomson-Eurotechnique	C	300	300	300	300	1,200
Thomson-Entocacuurdus	·		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%)	94	41	
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.QD	\$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		
		lst	2nd	3ed	4th	
		Qtr.	Qtr.	Qtr.	Otr.	Year
Market Share						
U.S.		67.9%	75.21	62.1%	70.2%	68.7%
Japan		8.81	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%

Table 3 (Continued)

32K MOS EPROM Shipment Data, 1978–1987

		1987						
	MOS	Lst	2nd	3rd	4th			
Process Otr.	Otr.	Otr.	<u>Qtr.</u>	Year				
AMD	N	425	500	475	575	1,975		
Pujitsu	N	0	0	0	0	0		
	-	-	0	0	0	0		
		-	0	0	0	Q		
Intel			1,300	1,100	1,100	4,550		
			0	0	0	0		
		-	0	0	0	0		
			750	744	628	2,872		
			20	20	10	150		
		•	0	0	0	0		
SGS-Thomson			559	471	560	2,275		
-			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		
	¢	825	815	794	673	3,107		
Total		4,585	4,194	3,860	3,718	16,357		
		(17%)	· (9%)	(8%)	(46)			
		•-	** **					
Cumulative Total		250,430	254,624	258,484	262,202			
ASPa: NAOS		\$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		
				1987				
		lst	2nd	3rd	4th			
		Otr.	Otr.	Otr.	Qtr.	<u>Year</u>		
Market Share								
v.s.		81.20	84.6%	86.0%	83.5%	83.79		
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%	100.04	100.01	100.09	100.04		

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

Source: Dataquest April 1988

Table 4

64K MOS EPROM Shipment Data, 1980-1987

	MOS	lst	2nd	1980 3rd	4th	
Company	Process	Qtr.	Otr.	Otr.	Otr.	Year
AMD	N	N/A	N/A	N/A	N/A	
Fugitsu	N	N/A	N/A	N/A	N/A	
tujicau	c	N/A	N/A	N/A	N/A	
Hitachi	Ň	N/A	N/A	N/A	5	
HI-Cachti	ċ	N/A	N/A	N/A	N/A	·
Intel	ж	•			S S	(
rucer	й	N/A	N/A	N/A	_	(
Mitsubishi	.я И	N/A	N/A N/A	N/A N/A	N/A	
		N/A			N/A	
Mostek	N	N/A	N/A	N/A	S	
Motorola	N	S	5	5	5	10
NEC	N	N/A	N/A	N/A	N/A	
	c 	H/A	H/A	N/A	H/A	9
Oki Electric	н	N/A	N/A	N/A	N/A	9
Ricoh	ç	N/A	N/A	N/A	N/A	
Rockwell	84	N/A	N/A	N/A	N/A	q
_	¢	N/A	N/A	N/A	H/A	9
Seeq	N	N/A	N/A	N/A	H/A	•
Seiko-Epson	С	N/A	N/A	N/A	N/A	•
5GS-Ates	N	N/A	N/A	N/A	H/A	0
Sharp	c	H/A	N/A	N/A	N/A	•
Signetics	C	H/A	N/A	H/A	N/A	0
Texas Instruments	n	N/A	\$	10	20	30
Toshiba	N	N/A	N/A	N/A	N/A	0
VLSI Technology	¢	H/A	N/A	N/A	N/A	
WaferScale Integ.	N	<u>N/A</u>	N/A	<u>N/A</u>	<u>N/A</u>	9
	N C	0	0	,15	25	40
	· ·	<u>—e</u>	0		0	0
Total		٥.	. 0	15	25	40
Percentage Change from Previous Quarter		0	0	0	678	
Cumulative Total		0	a	15	40	
		•	_			
ASPai NNOS CNOS		0 0	0	0	0	0
Overall		\$200.00	\$100.00	\$80.00	\$70.00	\$73.75
Revenue (\$M)		0	0	1.2	1.8	3.6
				1960		
		lst	2nd	3rd	4th	
		Otr.	Qte.	Qtr.	Qtr.	Year
Macket Share		_	_			
ñ.a.		0	0	100.00	100.00	100.0
Japan		0	0	0	0	0
Europe		_0	_0	0	0	0
Total		9	0	100.00	100.00	100.0
S = Sampling N/A = Not Available						

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

	MOS	lat	2nd	1981 3rd	4th	
Company	Process	Qtr.	Qtr.	Otr.	Otr.	Year
AMD	н	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
	С	N/A	N/A	N/A	N/A	0
Intel	N	10	70	200	500	780
	N N	N/A	N/A	N/A	N/A S	0
Mitsubishi Mostek	N	N/A S	N/A 2	N/A S	3	10
Motorola	N	15	40	30	50	135
NEC	'n	N/A	N/A	8/A	3	0
	Ċ	N/A	N/A	N/A	N/A	Ō
Oki Blectric	N	N/A	N/A	N/A	N/A	ō
Ricon	С	N/A	N/A	N/A	N/A	0
Rockwell	N	N/A	H/A	N/A	N/A	0
	c	N/A	N/A	N/A	H/A	0
Seeq	N	A/K	N/A	H/A	H/A	0
Seiko-Epeon	Ç	N/A	H/A	N/A	N/A	0
SGS-Ates	N C	N/A N/A	N/A N/A	H/A	N/A N/A	0
Sharp Signetics	¢	N/A	N/A	N/A N/A	N/A	ŏ
Texas Instruments	N	30	65	100	100	295
Toshiba	N N	H/A	N/A	N/A	H/A	-77
VLSI Technology	Ċ	N/A	N/A	N/A	N/A	ō
WaferScale Integ.	N	N/A	N/A	N/A	N/A	0
	N	55	180	355,	776	1,368
	¢	0		0	0	0
Total		55	180	355	778	1,368
Percentage Change from Previous Quarter		120%	2278	974	1194	
<u>-</u>						
Cumulative Total		95	275	630	1,408	
ASPs: NMOS 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
				1981		
		lat	2nd	3rd	4th	
		Ote.	Qtr.	Qtr.	Qtr.	Year
Market Share						
v.s.		100.04	98.3%	94.48	83.9%	89.2%
Japan		0	1.7	5.6	16.1	10.8
Entobe		0		0	0	0
Total		100.0%	100.00	100.0%	100.00	100.0%
S - Spenting						

S = Sampling N/A = Not Available

Table 4 (Continued)

64K MOS EPROM Shipment Data, 1980-1987

	MOS	lat	2nd	19 02 3ed	4th	
Сощрапу	Process	Otr.	Otr.	Otr.	Qtr.	Year
AMP.		s	10	250	500	760
AMD Buddhau	N	400	1,000	1,500	2,000	4.900
Fujit s u	Č	10	25	50	100	189
Hitachi	N	100	250	600	800	1,750
arcacit.	č	N/A	N/A	N/A	N/A	2,.50
Intel	N	800	1,700	2,500	2.500	7,500
THEST	Ŋ	N/A	N/A	N/A	N/A	,,,,,,
Mitsubishi	N		15	500	1,400	1,919
Mostek	N	ō	-0	0	0	
Motorola	N	60	100	100	100	360
NBC	N	\$	10	60	200	270
NEA-	ç	N/A	N/A	N/A	N/A	- (
Oki Blectric	N	N/A	N/A	N/A	s s	ò
Ricon	Č	N/A	N/A	N/A	N/A	ò
Rockwell	n	N/A	N/A	N/A	N/A	ā
KOCKW#11	č	N/A	N/A	N/A	N/A	ď
A	N	N/A		, s	15	20
Seeq	C	N/A	N/A	N/A	N/A	-
Seiko-Epson	N C	N/A	N/A	N/A	N/A	Ö
SGS-Ates	Č	N/A	N/A	N/A	N/A	
Sharp	č	N/A	N/A	N/A	N/A	Č
Signetics	н	100	100	100	100	400
Texas Instruments	H	N/A	S	20	50	70
Toshiba	Č	N/A	H/A	8/A	N/A	
VLSI Technology	N	-				č
WaferScale Integ.	N	N/A	N/A	N/A	N/A	
	N	1,460	3,185	5,635	7,665	17,945
	c	10	25	50	100	165
Total		1,470	3,210	5,685	7,765	18,130
Percentage Change from						
Previous Quarter		89%	1164	77%	37%	
Cumulative Total		2,878	6,0 68	11,773	19,538	
ASPs: NMOS		0	0	0	0	(
CMOS		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	157.4
				1982		_
		Lst	2nd	3rd	4th	
		Otr.	Otr.	Otr.	Otr.	<u>Year</u>
Market Share						
v.s.		65.30	59.5%	52.0	41.40	49.9
Japan		34.7	40.5	48-0	58.6	50.1
Europe		0	0	0	0	0
Total		100.01	100.0%	100.0%	100.04	100.0

S = Sampling N/A = Not Available

Table 4 (Continued)

64K MOS EPROM Shipment Data, 1980-1987

MOS					1983		
Company		NOS	lst	2nd		4th	
Pujitsu N 2,200 2,400 2,500 3,000 10,100 Ritachi N 1,500 2,300 3,500 4,000 1,300 Intel N 3,000 3,500 4,000 3,500 14,000 Intel N 3,000 3,500 4,000 3,500 14,000 Mitsubishi N 1,700 2,000 3,200 3,800 10,700 Motorola N 150 200 450 700 1,500 N&C N/A N/A N/A N/A N/A N/A N/A N/A N/A N/A	Company					otr.	Year
Pujitsu C 2,200 2,400 2,500 3,000 10,100 Hitachi C 259 300 350 400 1,300 Hitachi N 1,500 2,300 3,500 5,500 12,800 Intel N 3,000 3,500 4,000 3,500 12,800 Intel N 3,000 3,500 4,000 3,500 14,000 N N N/A N/A N/A N/A N/A N/A N/A N/A N/A	AMD	N	600	900	1,300	1,800	4,600
C 250 300 355 400 1,300 1,500 1,2800 1,500 2,300 3,500 5,500 10,800 1,500 1,500 1,4,000 1,500 1,4,000 1,500 1,4,000 1,500 1,4,000 1,500 1,000 1,500 1,000 1,500 1,000		N	2,200	2,400	2,500	3,000	10,100
Intel N	-	c	250	300	350		1,300
Intel	Hitachi	10	1,500	2,300	3,500	5,500	12,800
N		c	N/A	S	50	50	100
Mitsubishi	Intel	N	3,000	3,500	4,000	3,500	14,000
Motorola		N	N/A				
Notorola N	Mitsubishi		1,700				10,700
NBC							
Oki Electric							
Oki Electric N 25 50 100 200 375 Ricoh C N/A N/A<	NBC						
Ricoh C N/A N/A N/A N/A N/A N/A O							
No. No.				-			
Seeq		_		•			_
Seeq	Rockwell			-			
Selico-Epson	_					•	
SGS-Ates							
Sharp C N/A N/A N/A N/A O							
Signetics C				•		_	
Texas Instruments N		C			-		-
Toshiba	*				_	_	
VISI Technology C N/A							
N							-
N							
C 250 300 400 450 1,400	waterscale integ.	N					<u>v</u>
Total 10,400 13,450 18,160 22,750 64,760		84	10,150	13,150	17,760	22,300	63,360
Percentage Change from Previous Quarter 34% 29% 35% 25% 29% 35% 25% 29% 35% 25% 29% 35% 25% 29% 35% 25% 29% 35% 25% 29% 35% 25% 29% 35% 25% 29% 29% 29% 29% 29% 29% 29% 29% 29% 29		¢	250	300	400	450	1,400
Previous Quarter 34% 29% 35% 25% Cumulative Total 29,938 43,388 61,548 84,298 ASPs: NMOS 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Total		10,400	13,450	18,160	22,750	64,760
Previous Quarter 34% 29% 35% 25% Cumulative Total 29,938 43,388 61,548 84,298 ASPs: NMOS 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0							
Cumulative Total 29,938 43,388 61,548 84,298 ASPs: NMOS 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0			249	204	164	258	
ASPs: NMOS	Liestone Soutrer		344	234	334	234	
CMOS 0 0 0 0 0 0 0 0 0	Cumulative Total		29,938	43,388	61,548	84,298	٠.
Overall \$5.50 \$4.75 \$5.00 \$5.50 \$5.20 Revenue (\$M) 57.2 63.9 90.0 125.1 337.0							0
Revenue (\$M) 57.2 63.9 90.8 125.1 337.0	CHOS		-	-	0	0	0
1983 18t 2nd 3rd 4th Qtr. Qt	Overall		\$5.50	\$4.75	\$5.00	\$5. 50	\$5.20
1st 2nd 3rd 4th Qtr. Revenue (SM)		57.2	63.9	90.8	125.1	337.0	
Market Share U.S. 40.18 40.98 41.68 37.88 39.98 Japan 59.9 59.1 58.4 62.2 60.1 Europe 0 0 0 0 0 0					1983		
Otr. Otr. Otr. Otr. Year Market Share U.S. 40.18 40.98 41.68 37.88 39.98 Japan 59.9 59.1 58.4 62.2 60.1 Europe 0 0 0 0 0			lst	2nd		4th	
U.S. 40.16 40.96 41.68 37.88 39.96 Japan 59.9 59.1 58.4 62.2 60.1 Europe 0 0 0 0			Qtr.	Qtr.	Otr.	Otr.	Year
Japan 59.9 59.1 58.4 62.2 60.1 Europe 0 0 0 0 0							
Europe <u>0 0 0 0</u>							39.94
	•						60.1
Total 100.00 100.00 100.00 100.00 100.00	Europe		0	0	0	0	0
	Total		100.00	100.00	100.0%	100.00	100.04

S = Sampling N/A = Not Available

Table 4 (Continued)

64K MOS EPROM Shipment Data, 1980-1987

				1984		
	MOS	lst	2nd	3rd	4th	
Company	Process	Otr.	Otr.	Otr.	Otr.	Year
AMD	N	1,200	1,300	1,600	1,700	5,800
Pujitsu	н	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	10 0	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 0	5,700	5,00 0	21,400
Mostek	N N	900	900	600	500	2,900
Motorola NEC	N N	800	1,400	900	1,200	4,300
NEC	č	N/A	N/A	H/A	5	0
Oki Electric	Ň	400	600	500	400	1.900
Ricoh	č	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	900	500	2,900
VLSI Technology	c	H/A	N/A	H/A	N/A	0
WaferScale Integ.	N	N/A	N/A	N/A	H/A	0
	N	20,450	24,660	25,300	24,400	94.810
	č	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%)	211	36	(2%)	
Cumulative Total		105,358	130,928	157,263	183,023	
ASPs: NMOS		\$5.25	\$5.25	\$4.75	\$4.25	34.86
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		
		lst	2nd	3rd	4th	
		Qtr.	Otr.	Otr.	Qtr.	<u>Year</u>
Market Share						
u.s.		34.7%	30.84	30.60	29.9%	31.3%
Japan		65.l	68.6	68.1	67.7	67.5
Europe		0.2	0.6	1.3	2.3	1.2
Total		100.04	100.0%	100.0%	100.0%	100.0%
S = Sampling						

S = Sampling N/A = Not Available

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

				1985		
	MOS	lst	2nd	3cd	4th	
Company	<u>Process</u>	<u>Qtr.</u>	Otr.	Otr.	Qtr.	Year
NAD.	ы	2,100	1,550	1,825	1,150	6,625
Pujit su	N	3,500	3,500	3,800	3,500	14,300
-	¢	800	950	1,000	1,200	3,950
Hitachi	N	5,500	5,200	5,000	4,500	20,200
	С	400	400	450	500	1,750
[ntel	Ħ	2,600	3,000	3,000	2,900	11,500
	n	25	75	150	250	50 0
litsubishi	N	4,850	2,600	4,300	4,200	15,950
łostek	М	0	0	0	0	0
(otorola	N	400	300	300	400	1,400
IBC	N	1,250	1,450	1,650	1,800	6,150
	c	40	200	35G	300	890
ki Electric	н	350	300	200	150	1,000
Ricoh	c	200	250	250	150	850
lockwell	N	0	0	0	0	0
	c	0	0	0	0	0
ieeq .	N	625	500	350	275	1,750
ie i ko-Epson	С	N/A	N/A	N/A	s	0
GS	N	680	850	1,000	1,350	4,080
iharp	¢	N/A	N/A	H/A	ş	٥
Signetics	c	0	0	0	0	0
Texas Instruments	N	2,200	2,000	2,000	2,000	8,200
Coshiba	N	600	600	500	350	2,250
VLSI Technology	С	N/A	s	20	40	60
WaferScale Integ.	N	N/A	<u>H/A</u>	<u> </u>	10	10
	N	25,080	21,925	24,075	22,825	93,905
	č	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		31	(114)	10\$	(48)	
Cumulative Total		209,543	233,268	259,413	284,436	
ASPs: NMOS		\$3.60	\$2.80	\$2.35	\$2.10	\$2,73
ASPS: NAMOS 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
		lst	2nd	1985 3rd	4th	
		Otr.	Qtr.	Otr.	Qtr.	Year
Market Share						
v.s.		30.04	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

S = Sampling N/A = Not Available

Table 4 (Continued)

64K MOS EPROM Shipment Data, 1980-1987

		-		1986		
	M06	lat	2nd	319	4th	
Company	Process	Otr.	Otr.	Otr.	Qtr.	Year
		***	800	900	1,385	3,935
AMO	N N	850	1,500	2,000	4,000	9,000
Fujitsu	Č	1,500 1,000	1.000	2,000	4,000	8,000
General Instruments	c	1,000 S	1,000	31	170	201
General thattaments	OTP	N/A	N/A	s	10	10
Goldstar	č	s	s	ō	5	5
Hitachi	N	5,400	5,000	4,500	4,000	18,900
	¢	700	700	700	700	2,800
Hyundai	С	s	s	O	5	5
Intel	ħ	3,400	3,300	2,400	3,200	12,300
	¢	250	500	425	400	1,575
	N OTP	400	400	300	200	1,300
Mitsubishi	C OTP	0 3,2 26	30 3,339	130 3,459	100 2,810	260 12,834
Wicedolaul	0779	775	43	564	511	1,893
Motorola	N N	147	346	177	114	784
(NOCOTOTA	OTP	66	87	54	22	229
National Semi.	c	25	75	150	200	450
NEC	Ň	1,850	1,000	300	150	3,300
	Ç	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
Seik o-Epe on	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	>	10	20
Texas Instruments	N	1,400	1,400	1,800	1,600	6,200
Toshiba	N OTP	500 100	600 400	600 500	900 500	2,600
VLSI Technology	C	40	40	40	50	1,500 17 0
WaferScale Integ.	c	0	10	10	10	30
Others	č	ŏ	Õ	5	5	10
4 1 4 12	•		<u> </u>		<u>`</u>	
	N	20,691	19,438	20,369	22,042	82,540
	C	3,055	3,580	4,221	6,230	17,086
m-1-1						
Total		23,746	23,018	24,590	20,272	99,626
Percentage Change from Previous Quarter		(59)	(3%)	79	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	\$2.01	\$3.05	\$2.71
Revenue (\$M)		55.2	59.1	69.2	86.2	269.7
				1986		
		lst	2nd	3rd	4th	
		Qtr.	Otr.	Otr.	Qtr.	Year
Market Share				<u> </u>		
U.S.		29.96	33.14	27.49	27.08	29.24
Japan		67.0	64.3	62.4	64.1	64.6
Burope		2.3	2.6	10.2	8.8	6.2
ROW		0	0	0	0	0
Total		100.0%	100.04	100.0%	100.0%	100 01

S = Sampling N/A = Not Available

MOS EPROM—Data

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

				1987		
	MOS	lst	2nd	3rd	4th	
Company	Process	Qtr.	Qtr.	Otr.	Otr.	Year
AMD	N	1,300	1,500	1,150	1,750	5,700
Cypress	C	50	75	100	100	325
Fujiteu	N	400	500	800	800	2,500
	c	1,800	2,000	2,200	2,200	8,200
Goldstar	С	5	5	5	5	20
Hitachi	N	2,500	1,500	1.000	0	5,000
	С	700	700	400	0	1,800
	C OTP	٥	50	100	0	150
Hyundai	c	\$	5	10	20	40
Intel	N	1,400	1,400	1,100	1,700	5,600
	¢	400	400	500	400	1,700
•	N OTP	350	300	150	250	1,050
	COTP	200	250	200	200	850
Microchip Tech., Inc.	c	100	200	350	500	1,150
•	QTP	10	20	50	100	180
Mitsubishi	H	1,450	1,150	1,250	1,700	5,550
	OTP	450	250	200	350	1,250
Motorola	н	125	100	86	60	371
	OTP	17	10	13	6	46
National Semi.	c	606	1,198	1,580	2,341	5,725
	COTP	N/A	N/A	N/A	s	0
NEC	N	400	60	70	0	\$30
	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	¢	50	50	100 ,	100	300
Seeq	N	200	200	200	200	800
Seiko-Epson	¢	100	100	100	100	400
SGS-Thomson	N	872	1,643	2,081	2,100	6,696
	¢	80	110	40	100	330
	C OTP	5	45	70	100	220
Sharp	c	Q	80	150	250	480
	OTP	0	0	0	0	0
Signetics	¢	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

Table 4 (Continued)

64K MOS EPROM Shipment Data, 1980-1987

Percentage Change from					
Previous Quarter	(36%)	(2%)	29	54	
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		
	lst	2nd	3rd	4th	
	Otr.	Otr.	Otr.	Otr.	Year
Market Share					
U.S.	33.9%	40.46	39.8%	49.4%	41.0%
Japan	60.8	49.4	48.0	30.4	49.0
Europe	5.3	10.1	12.1	12.1	9.9
ROW	0.1	0.1	<u>0.1</u>	<u>1.0</u>	<u> 0.1</u>
Total	100.01	100.0%	100.00	100.00	100.00

S = Sampling M/A = Not Available Note: Columns may not add to totals shown because of rounding.

Source: Dataquest April 1988

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

	MOS	lst	2nd	3rd	4ch	
Соправу	Process	Qtr.	Qtr.	<u>Otr.</u>	Otr.	<u>Year</u>
AMD	И	M/A	N/A	N/A	s	g
Fujitsu	N	N/A	N/A	N/A	s	0
	С	N/A	N/A	N/A	N/A	٥
Hitachi	N	N/A	N/A	N/A	s	0
Intel	N	3	15	50	150	218
Mitsubishi	N	N/A	N/A	H/A	N/A	0
	C	H/A	N/A	N/A	N/A	0
NEC	N	N/A	N/A	H/A	N/A	0
Seeq	Ħ	N/A	H/A	N/A	s	9
Texas Instruments	N	N/A	8	5	5	10
	c	N/A	N/A	N/A	N/A	0
Toshiba	N	N/A	N/A	N/A	<u>N/A</u>	N/A
	N	3	15	55	155	228
	ĉ	ŏ				
	-					
Total		3	15	55	155	228
Percentage Change from Previous Quarter		0	400%	267	1921	
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		
		lst	2nd	3rd	4th	
		Otr.	Otr.	Qtr.	Otr.	Year
Market Share						
U.S.		100.04	100.00	100.04	100.0%	100.04
Japan		o	0	Q	0	0
Europe				ā	ŏ	ŏ
Total		100.00	100.01	100.0%	100.0%	100.0%

S = Sampling N/A = Not Available

MOS EPROM—Data

Table 5 (Continued)

128K MOS EPROM Shipment Data, 1982–1987

	1983							
	MOS	lst	2nd	324	4th			
Company	Process	Otr.	Otr.	Otr.	Qtr.	<u>Year</u>		
AMD	N	50	175	300	500	1,025		
Fujitsu	N	10	50	150	350	560		
	С	s	10	25	35	70		
Hitachi	N	10	50	150	350	560		
Intel	И	450	800	1,200	1,500	3,950		
Mitsubishi	N	S	10	10	10	30		
	c	N/A	N/A	H/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		
	C	N/A	N/A	N/A	N/A	0		
Toshiba	N	<u>s</u>	10	20	50	60		
	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	1146	73%	564			
Cumulative Total		748	1,863	3,786	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		
				1983				
		lst	2nd	319	4th			
		Otr.	Otr.	Otr.	Otr.	Year		
Market Share								
U.S.		96.2%	87.4%	80.5%	70.10	78.2%		
Japan		3.8	12.6	19.5	29.9	21.8		
Europe		0	0	0	0	0		
Total		1,00.0%	100.0%	100.0%	100.04	100.0%		

S = Sampling N/A = Not Available

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

	MOS	let	2nd	364	4th			
Company	Process	Qtr.	Otr.	Qtr.	Otr.	<u>Year</u>		
AMD	N	500	600	850	900	3,050		
Pujitsu	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	H/A	ş	0		
NEC	N	20	160	600	1,000	1,780		
Seeq	М	T20	400	525	575	1,650		
Texas Instruments	Ņ	10	25	25	25	65		
	c	N/A	N/A	N/A	N/A	0		
Toshiba	H	100	300		900	1,800		
	N	3,540	6,235	8,500	11,300	29,575		
	¢	<u> 50</u>	<u>75</u>	100	100	325		
Total		3,590	6,310	8,600	11,400	29,900		
Percentage Change from Previous Quarter Cumulative Total		20 4 10.373	76 3	36% 25,283	13 % 36,683			
				•	•			
ASP#: 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		
				1984				
		ist	2nd	3cd	4th			
		Ote.	Qtr.	Otr.	Qtr.	Year		
Market Share								
v.s.		60.20	44.80	36.0%	32.5%	39.41		
Japan		39.8	55.2	64.0	67.5	60.6		
Entobe		0	0	0	0	0		
Total		100.0	100.0%	100.0%	100.0%	100.09		
S = Sampling N/A = Not Available								

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

				1985		
	MOS	lst	2nd	304	4th	
Company	Process	Otr.	Otr.	Otr.	Qtr.	Xeac.
AMD	N	1,150	950	850	900	3,850
Pujitsu	N	1,000	1,500	1,750	2,000	6,250
	С	100	100	100	100	400
Hitachi	N	3,000	3,200	3,500	3,100	12,800
Intel	н	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	2,600	1,750	3,200	8,450
Seeq	N	375	300	250	225	1,150
Texas Instruments	N	50	25	0	0	75
Toshiba	C N	N/A	N/A	\$	25	25
TOBRIDE	N	1,000	1,200	1,500	1,500	5,200
	N	11,875	12,975	14,300	16,125	55,275
	С	105	110	110	225	550
Total		11,980	13,085	14,410	16,350	55,825
Percentage Change from Previous Quarter		59	9\$	109	134	
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	42.6	220.6
				1985		
		lst	Žnd	3rd	4th	
		Otr.	Otr.	Otr.	Otr.	Year
Market Share						
U.S.		29.8%	23.50	21.5%	20.5%	23./50
Japan		70.2	76.5	78.5	79.5	76.5
Europe		0	0	0	0	0
Total		100.00	100.04	100.04	100.00	100.00

S = Sampling N/A = Not Available

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

				1986		
	MOS	lst	2nd	3rd	4th	
Company	Process	Otr.	Otr.	Otr.	Otr.	<u>Year</u>
AMD	N	1,300	1,100	1,050	1,715	5,165
Fujitsu	N	900	800	800	800	3,200
-	C	100	100	100	100	400
General Instrument	¢	N/A	S	20	150	170
	OTP	N/A	N/A	\$	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	И	2,300	1,850	1,800	1.700	7,650
	C	75	70	90	120	355
	N OTP	650	650	550	300	2,150
NBC	C OTP N	0 3,11 0	0 3,0 0 0	0 1.520	1.000	0 0.630
==	N N	3,110	325	300	225	1,175
Seeq Seiko-Epson	N	327 O	10	15	25	50
Texas Instruments	N	N/A	N/A	N/A	N/A	0
Texas Tiberomentes	č	100	175	225	400	900
Toshiba	N	700	700	700	600	2,700
tosu tha	OTP	50	200	400	600	1,250
VLSI Technology	C	5	10	10	10	35
WaferScale Integ.	č	ś	0	. 5	5	10
Others	č	N/A	š	5	10	15
OCH#10	•	11/12	<u>_</u>	<u>-</u>		
	N	14,835	14,735	13,065	12,780	55,435
	c	280	355	<u>455</u>	805	1,895
Total		15,115	15,090	13,540	13,585	57,330
Percentage Change from Previous Quarter Cumulative Total		(8%) 107,623	0 122,713	(10%) 136,253	0 149,123	
ASPs: NHOS		\$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 (\$H)		38.9	40.4	37.8	38.4	155.5
				1986		
		ist	2nd	3rd	4th	
		Otr.	Qtr.	Otr.	Otr.	Year
Market Share						
U.S.		27.3%	31.20	37.48	42.91	34.48
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%	100.00
S = Sampling N/A = Not Applicable						

Table 5 (Continued)

128K MOS EPROM Shipment Data, 1982-1987

				1987		
	MOS	lst	2nd	Jrd	4th	
Company	Process	ote.	Otr.	Otr.	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
	С	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
	COTP	0	0	20	20	40
Microchip Tech., Inc.	С	200	250	420	400	1,270
	COTP	20	45	80	200	345
Mitaubishi	И	1,150	1,300	1,400	950	4,800
	C	40	100	130	60	330
	N OTP	120	250	300	100	770
	C OTP	Q	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 OTTP	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	H	0 800	25 900	25	70	120
	C N	500	500	1,000 600	1,200 600	3,900
Toshiba						2,200
VLSI Technology	C NOTP	900 5	1,000 10	1,000 10	1,000 10	3,900 35
WaferScale Integ.	c	5	10			10
waterscale integ.	·			5	5	
	N	11,698	12,925	11,572	10,690	46,885
	ç	1,887	2,396	3,038	3,485	10,806
	•			7.7.7.	777.00	******
Total		13,585	15,321	14,610	14,175	57,691
Percentage Change from		61				
Previous Quarter		94	13%	(5%)	(3%)	
Cumulative Total		162,708	178,029	192,639	206,814	
ASPa: NMOS		\$3.00	\$3.35	43 40	42 75	
CMQS		\$3.90	\$3.80	\$3.45 \$3.90	\$3.75 \$4.25	\$ 3.38 \$ 3.99
Overall		\$3.13	\$3.42	\$3.54	\$3.87	\$ 3.49
044441		*****	43.42	33.34	*3.61	3.49
Revenue (\$M)		42.5	52.4	51.8	54.9	201.5
				1987		
		lst	2nd	3rd	4th	
		Otr.	Otr.	Qtr.	Otr.	Year
Market Share						
U.S.		41.9%	42.14	36.19	49.1%	42.30
Japan		56.8	54.5	56.0	38.9	51.6
Europe		1.3	3.4	7.9	12.0	6.2
-				•		
Total		100.00	100.0%	100.04	100.04	100.0%

S = Sampling N/A \Rightarrow Not Applicable Note: Columns may not add to totalm shown because of rounding.

Source: Dataquest April 1988

Table 6 256K MOS EPROM Shipment Data, 1983-1987

				1983		_
Company	MGS	lst	2nd	Jed Oh-	4th	٧
Company	Process	Otr.	Otr.	<u>Qtr.</u>	Qtr.	Year
AMD	N	N/A	S	10	25	35
Atmel	И	N/A	N/A	N/A	N/A	- (
	¢	N/A	H/A	N/A	N/A	(
Fujitsu	N	N/A	N/A	N/A	N/A	(
General Instrument	C	S N/A	S N/A	5 N/A	20 N/A	25
deneral Inscrument	C N	N/A	N/A	N/A	N/A N/A	ì
Hitachi	N	N/A	N/A	N/A	N/A	
	c	N/A	H/A	N/A	N/A	
Intel	N	5	10	35	90	140
	ë	N/A	N/A	N/A	H/A	
Miteubishi	N	N/A	N/A	N/A	8	Ċ
National Semi.	С	N/A	N/A	N/A	N/A	į.
NEC	N	N/A	N/A	N/A	s	(
	c	N/A	N/A	N/A	H/A	(
Seeq	c	N/A	N/A	N/A	N/A	(
Seiko-Epson	С	N/A	N/A	N/A	N/A	- (
SGS-Ates	N	N/A	H/A	N/A	N/A	
Texas Instruments	С	N/A	N/A	N/A	N/A	(
Toshiba	N	N/A	N/A	N/A	N/A	- (
	С	H/A	N/A	N/A	N/A	(
VLSI Technology	С	N/A	N/A	N/A	N/A	
WaferScale Integ.	c	N/A	N/A	<u>N/A</u>	N/A	
	N	5	10	45	115	17
	c	0	0	5		
Total		5	10	so	135	200
Percentage Change from						
Previous Quarter		0	1009	400%	1709	
Cumulative Total		5	15	65	200	
ASPS: NMOS		\$150	\$125	\$100	\$95	\$10
CMOS		0	0	\$145	\$115	\$12
Overall		\$150	\$125	\$105	\$98	\$10
Revenue (\$N)		0.8	1.3	5.2	13.2	20.9
				1983		_
		lst	2nd	3rd	4th	
		Otr.	Qtr.	Otr.	Otr.	Year
Market Share						
o.ş.		100.0%	100.04	#0.001	100.0%	100.0
Japan		0	0	0	Q	0
Europe		0	0	0	0	0
Total		\$0.001	100.08	100.04	100.00	100.01

N/A - Not Available

Table 6 (Continued)
256K MOS EPROM Shipment Data, 1983–1987

				1984		
	MOS	lst	2nd	3rd	4th	
Company	Process.	Otr.	Qtr.	<u>Qtr.</u>	Otr,	Year
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
Pujitsu	И	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
make in the	Ç	N/A	N/A	N/A	N/A	0
Hitachi	N C	N/A	N/A N/A	S S	S S	0
Intel	H	N/A 150	250	375	475	1,250
TiteAT	Č	N/A	N/A	N/A	N/A	1,230
Mitsubishi	N	S	S	s s	5	5
National Semi.	č	N/A	N/A	N/A	N/A	0
NEC	Ň	", s	5	s	, 5	5
	ë	N/A	N/A	H/A	N/A	ō
Seeq	ċ	N/A	s	s	5	5
Seiko-Epson	ě	N/A	H/A	N/A	N/A	ă
SGS	N	N/A	N/A	N/A	N/A	ō
Texas Instruments	c	N/A	N/A	H/A	N/A	ò
Toshiba	N	10	30	50	100	190
	C	N/A	N/A	\$	s	. 0
VLSI Technology	C	N/A	N/A	N/A	N/A	0
WaferScale Integ.	С	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%	281	618	
Cumulative Total		490	940	1.515	2,440	
					-•	
ASPa; NMQS CMO6		\$75.00 \$100.00	\$45.00 \$80.00	\$35.00	\$28.00	\$39.21
Overall		\$77.59	\$49.11	\$60.00 \$37.17	\$45.00	\$64.00
CASTALL		\$77.59	349-11	*37.17	\$29.47	\$41,42
Revenue (\$M)		22.5	21.7	21.4	27.3	92.8
				1984		
		lat	2nd	3cd	4th	
		otr.	Otr.	Qtr.	Otr.	Year
Market Share						
u.s.		86.24	84.41	82.64	78.90	81.9%
Јарал		13.8	15.6	17.4	21.1	18.1
Europe		0	0	0	0	0
Total		100.04	100.0%	100.03	100.0%	100.04

S = Sampling N/A = Not Available

Table 6 (Continued) 256K MOS EPROM Shipment Data, 1983-1987

		1985						
	MOS	lst	2nd	3rd	4th			
Company	Process	Otr.	Otr.	Otr.	Otr.	<u>Year</u>		
AMD	N	450	800	950	950	3,150		
Atmel	и	N/A	N/A	N/A	s	0		
	c	H/A	N/A	N/A	3	0		
Fujitsu	Н	25	300	400	650	1,275		
	C	150	250	400	600	1,400		
General Instrument	N C	N/A	N/A	5 S	25	25		
Hitachi	ม	N/A 50	N/A 200	500	10 800	10 1,550		
RIEGERI	Č	50 S	25	150	300	475		
Intel	ห	1,000	1,800	2,400	2,700	7,900		
	č	N/A	5	50	100	150		
Mitsubishi	N		25	70	600	700		
National Semi.	С	\$	s	s	10	10		
NEC	И	30	230	550	750	1,560		
	c	S	50	150	200	400		
Seeq	c	15	110	180	250	555		
Seiko-Epson	¢	N/A	16/A	n/a	S	0		
SGS	N	H/A	N/A	s	10	10		
Texas Instruments	¢	N/A	N/A	S	50	50		
Toshiba	N	150	350	550	700	1,750		
	c	150	200	300	425	1,075		
VLSI Technology	ç C	H/A	\$ ***	25	50	75		
WaferScale Integ.	·	<u> N/A</u>	H/A	<u>s</u>	<u>s</u>	 e		
	N	1,710	3,605	5,420	7,185	17,920		
	С	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%	1094	570	38%			
Cumulative Total		4,465	8,705	15,360	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				
		lst	2nd	3rd	4th			
		Otr.	Otr.	Otr.	Qtr.	Year		
Market Share								
v.s.		72.3%	63.90	54.0%	45.21	53.9%		
Japan		27.7	36.1	46.0	54.7	46.0		
Euro pe		0	0	0	1.0	0		
Total		100.0%	100.0	100.09	100.0%	100.00		
S = Sampling								

N/A = Not Available

Table 6 (Continued)

256K MOS EPROM Shipment Data, 1983–1987

				1986		
	MOS	lst	2 <u>n</u> đ	3rd	4th	
Company	Process	Otr.	Otr.	Otr.	Otr.	Year
AMD	И	700	1,000	1,050	1,000	3,750
Atmel	N	0	0	0	0	0
	С	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
	С	112	317	493	500	1,422
	C OTP	35	85	10	200	330
Hitachi	N	950	1,100	1,350	1,500	4,900
	Ç	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	И	1,637	2,096	1,776	935	6,444
	С	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.	Ċ	25	100	250	300	675
NEC	И	1,230	1,250	990	500	3,970
	C	1,620	1,220	1,140	800	4,780
Oki Electric	И	N/A	S	0	30	30
Ricoh	С	0	0	5	5	10
Seeq	С	70	70	40	40	220
Seiko-Epson	С	0	5	10	10	25
SGS	N	6	136	10	10	162
Signetics	С	S	S	5	15	20
Texas Instrument	С	125	200	225	800	1,350
Toshiba	n	600	800	800	800	3,000
	С	300	400	400	400	1,500
	N OTP	300	500	800	1,200	2,800
	C OTP	100	200	200	200	700
VLSI Technology	С	50	50	50	50	200
WaferScale Integ.	C	S	5	5	5	15
Others	N	0	0	0	0	0
	С	5	5	<u>5</u>	5	20
	N	11,580	13,712	13,736	14,810	53,838
	С	3,142	3,582	4,207	<u>5,237</u>	<u>16,168</u>
Total		14,722	17,294	17,943	20,047	70,006

Table 6 (Continued) 256K MOS EPROM Shipment Data, 1983-1987

		_	1986		
	lst	2nd	3rd	4th	
	Otr.	Otr.	Otr.	Otr.	<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		
_	lst	2nd	3rd	4th	•
	Otr.	Otr.	Otr.	Otr.	<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	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.

Table 6 (Continued)
256K MOS EPROM Shipment Data, 1983-1987

		1987						
	MOS	lst	2nd	3rd	4th	-		
Company	Process	Otr.	Otr.	Otr.	Otr.	Year		
AMD	И	1,585	1,850	1,600	2,175	7,210		
	С	0	10	100	400	510		
Fujitsu	N	900	800	950	900	3,550		
	¢	700	1,700	2,050	2,500	6,950		
Hitachi	И	2,500	2,500	1,500	0	6,500		
	С	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		
	С	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		
-	С	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		
	С	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	И	690	540	360	400	1,990		
	С	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		
Seeg	Ċ	75	75	75	75	300		
Seiko-Epson	Ċ	20	20	20	10	70		
SGS-Thomson	И	836	1,162	1,170	1,600	4,768		
Signetics	С	200	250	300	300	1,050		
Texas Instrument	Ċ	1,500	1,500	1,800	2,000	6,800		
Toshiba	N	800	800	1,000	1,500	4,100		
	С	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.	С	15	20	20	30	85		
	N	17,761	19,602	17,480	17,075	71,918		
	С	9,234	11,187	14,031	13,555	48,007		
Total		26,995	30,789	31,511	30,630	119,925		

Table 6 (Continued) 256K MOS EPROM Shipment Data, 1983-1987

			1987		
	lst	2nd	3rd	4th	
	Otr.	Otr.	Otr.	Otr.	<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		
	lst	2nd	3rd	4th	
	Otr.	Otr.	Otr.	Otr.	<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>	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

Table 7
512K MOS EPROM Shipment Data, 1984–1987

	1984						
	HOS	lst	2nd	3rd	4th		
Company	Process	Otr.	<u>Qtr.</u>	Otr.	Otr.	<u>Year</u>	
AMD	Ħ	s	2	2	4	8	
Fujitsu	И	N/A	N/A	N/A	N/A	0	
General Instrument	С	N/A	N/A	N/A	N/A	0	
Kitachi	N	N/A	N/A	N/A	N/A	0	
	¢	N/A	N/A	N/A	N/A	0	
Intel	N	N/A	3	2	6	6	
Mitsubishi	N	N/A	N/A	N/A	N/A	0	
Toshiba	H	N/A	N/A	N/A	N/A	0	
	С	N/A	N/A	N/A	N/A	0	
VLSI Technology	Ç	N/A	N/A	N/A	N/A	0	
WaferScale Integ.	С	H/A	N/A	<u>n/a</u>	<u>n/a</u>	0	
•	N	0	2	4	10	16	
	¢	0	_0	_0		_0	
Total		0	2	4	10	16	
Percentage Change from Previous Quarter		0	0	100%	1501		
Comulative Total		۰	2	6	16		
					_		
ASPa: NMOS		\$250.00	\$150.00	\$120.30	\$95.00	\$108.13	
CMOS		0	0	0	0	¢	
Overall		\$250.00	\$150.00	\$120. Q0	\$95.00	\$108.13	
Revenue (\$2)		0	0.3	0.5	1.0	1.7	
				1984			
		lst	2nd	3rd	4th		
		Qtr.	Otr.	Otr.	Qtr.	Year	
Market Share							
u.s.		Q	100.04	100.0%	100.04	100.0%	
Japan		0	Q.	0	0	0	
Europe		0	0		0	0	
Total		G	100.00	100.0%	100.00	100.00	
S = Sampling							

S = Sampling N/A = Not Available

Table 7 (Continued) 512K MOS EPROM Shipment Data, 1984-1987

				1985		
	MOS	lst	2nd	3rd	4th	
Company	Process	Otr.	Otr.	Otr.	Otr.	<u>Year</u>
AMD	N	12	30	35	75	152
Fujitsu	N	N/A	N/A	ş	10	10
General Instrument	c	N/A	N/A	N/A	N/A	0
Hitachi	N	N/A	N/A	s	15	15
	С	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
	¢	N/A	N/A	N/A	N/A	0
VLSI Technology	¢	N/A	N/A	N/A	N/A	0
WaferScale Integ.	С	N/A	M/A	<u>N/A</u>	N/A	0
	N	27	80	100	225	432
	С	0	0	0	_10	<u> 10</u>
Total		27	80	100	235	442
Percentage Change from Previous Quarter		1700	1964	259	1350	
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		\$32.49
Revenue (\$M)		2.2	4.0	3.0	5.2	14.4
				1985		
		lst	2nd	3rd	4th	
		Otr.	Qtr.	Qtr.	Otr.	<u>Year</u>
Market Share						
u.s.		100.00	100.0%	100.0%	89.4%	94.3%
Japan		0	O	9	10.6	5.7
Europe		0	0	0	0	0

S = Sampling N/A = Not Available

MOS EPROM—Data

Table 7 (Continued)
512K MOS EPROM Shipment Data, 1984–1987

				1986		
	MOS	lst	2nd	3rd	4th	
Company	Process	Otr.	Otr.	Otr.	<u>Qtr.</u>	<u>Year</u>
AMD	N	175	280	540	400	1,395
Pujitsu	С	25	25	25	25	100
General Instrument	¢	s	10	25	100	135
	OTP	H/A	N/A	s	5	5
Hitachi	И	N/A	5	60	300	360
	С	N/A	N/A	N/A	N/A	0
Intel	*	250	400	730	900	2,280
Mitsubishi	N	N/A	5	58	365	423
National Semi.	C	N/A	5	0	Q	0
Oki Electric	и	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	С	S	0	3	5	8
WaferScale Integ.	c	N/A	N/A	N/A	N/A	.0
Others	c	<u>s</u>	5	5	5	15
	N	475	830	1,688	2,395	5,388
	C	25	40	58	<u> 190</u>	313
Total		500	870	1,746	2,585	5,701
Percentage Change from						
Previous Quarter		1139	741	1014	481	
Cumulative Total		958	1,828	3,574	6,159	
ASPs: NHOS		\$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	28.9	67.6
				1986		
		lst	2nd	3rd	4th	
		Otr.	Otr.	Otr.	Otr.	Year
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		100.01	100.00	100.0%	100.0%	100.0

S = Sampling N/A = Not Available

Table 7 (Continued)
512K MOS EPROM Shipment Data, 1984–1987

		1987						
	MOS	lst	2nd	3rd	4th			
Company	Process	Otr.	Otr.	Otr.	Otr.	<u>Year</u>		
AMD:	H	740	785	525	565	2,615		
	¢	5	5	25	435	465		
Pujitsu	c	500	1,500	1,800	2,100	5,900		
Hitachi	N C	75 0 S	800 0	8 50 0	9 50 0	3,350 0		
Intel	N.	800	1.200	1.600	2,700	6.500		
Microchip Tech., Inc.	č	100	150	100	100	450		
morough teems, and,	OTP	10	10	20	20	60		
Mitsubishi	N	750	800	1,200	1,450	4,200		
National Semi.	ç	0	o	0	0	0		
NEC	Ċ	N/A	s	ó	1,050	1,050		
Oki Electric	N	0	180	200	400	780		
	N OTP	0	179	200	650	1,020		
SGS-Thomson	N	N/A	1	50	350	401		
Texas Instruments	С	100	200	30Q	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	<u> </u>	°	0	0		
	N	3,790	4,616	5,605	7,935	21,946		
	С		1,870	2,250	4,113	8,948		
Total		4,505	6,486	7,855	12,048	30,895		
Percentage Change from Previous Quarter		749	448	; 21 3	534			
stsatona Angrest		/44	111	214	234			
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	\$6.68		
Overall		\$10.16	\$ 9.29	\$8.13	\$7.04	\$8.24		
Revenue (\$M)		45.8	60.2	63.9	84.8	254.7		
				1987		_		
		lst	2nd	3rd	4th			
		Otr.	Otr.	Qtr.	Qtr.	Year		
Market Share								
v.S.		39.0%	36.36	35.3%	35.1%	36.00		
Japan		61.0	63.7	64.0	62.0	62.7		
Europe		0	0	0.6	2.9	1.3		
Total		100.00	100.0%	100.01	100.0%	100.0%		

S = Sampling N/A = Not Available

> Source: Dataquest April 1988

Table 8
1-Mbit MOS EPROM Shipment Data, 1986-1987

					1986		
	NOS	Technology	let	2nd	3rd	4th	
Company	Process	<u>Features</u>	Ote.	Otr.	Otr.	Otr.	<u> Aeat</u>
AMD .	c	×16	1	1	4	6	12
Atmel	С	N/A	0	_	_		
Fujitsu	c	x 8, x16	N/A			_	_
General Instrument	c	x16	N/A			,	
Hitachi	c	x8, x16	S				
Intel	N	x8, x16	ş			-	
Motorola	Ċ	N/A	3	_	_		
	c	x8, x16 x16	N/A			-	
	c	x16	H/A N/A		_		
· -	c	N/A	N/A				
	Č	x6	N/A				
	c	N/A	N/A		_		
National Semi. NEC Oki Electric Texas Instruments Toshiba Other Total Percentage Change fro Previous Quarter Cumulative Total	•	B/ F.	W/ A	<u> </u>	<u> </u>	0	
	N		0	5	25	30	60
	С		1	_11	_39	_98	149
Total			1	16	64	128	209
Previous Quarter	OR .		0	3,100% 17		10 0 9	
ASPa: NMOS			\$110.00	\$80.00	\$50.00	\$42.00	\$48.50
CM05			\$150.00				
Overall			\$150.00				
Revenue (\$N)			0.1	1.2	3,8	7.1	12.2
					1986		
			let	2nđ	3rd	4th	
			Otr.	Otr.	Qtr.	Qtr.	Year
Market Share							
v.s.			100.0%	37.5%	45.34	28.14	34.30
Japan			0	62.5	54.7	71.9	65.7
gatobe			0	0		0	0
Total			100.0%	100.0%	100.08	100.04	100.00
S = Sampling N/A = Not Available							

Table 8 (Continued)

1-Mbit MOS EPROM Shipment Data, 1986-1987

•			1987				
	MOS	Technology	let	2nd	Jed	4th	
Company	Process	<u>Features</u>	Qtr.	Qtr.	Otr.	Otr.	Year
AMD	¢	x16	6	10	25	50	91
fujitsu	С	×8, ×16	N/A	S	5	10	15
Ritachi	C	x8, x16	0	70	150		
Intel	N	x8, x16	50				
Microchip Tech., Inc.	c		H/A				
Mitsubishi	¢	x8, x16	0	-			
National Semi.	C	x8, x16	0	-	-	-	0
NEC	c	x8	N/A				
at ! = 1 1 -	C	x16	N/A				150
Oki Electric	c	x8, x16	N/A	-		_	0
SGS-Thomson	Ċ		N/A				0
Texas Instruments	c		0		-	-	
Toshiba	c	x8, x16		40		<u>50</u>	150
	N		50				310
	С		<u>26</u>	125	325	825	1,301
Total			76	155	405	975	1,611
Percentage Change from Previous Quarter	•			104%	161%	1418	
Cumulative Total			285	440	845	1,820	
ASPs: NHOS						\$24.00	
CHOS						\$26,00	
Overall			\$30.79	\$30.45	\$27.21	\$25.69	\$26.77
Revenue (\$M)			2.3	4.7	11.0	25.1	43.1
					1987		
			lat	Znd	3rd	4th	
			Qte.	Qtr.	Qtr.	Qtr.	Teac
Macket Share							
y.S.			73.7%	25.8%	25.9%	20.5%	24.90
Japan			26.3	74.2	74.1	79.5	75.1
Europe			0	0	0	0	0
Total			100.0%	100.0%	100.04	100.01	100.0%

Source: Detaquest April 1988

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