

Microcontroller Forecast Summary

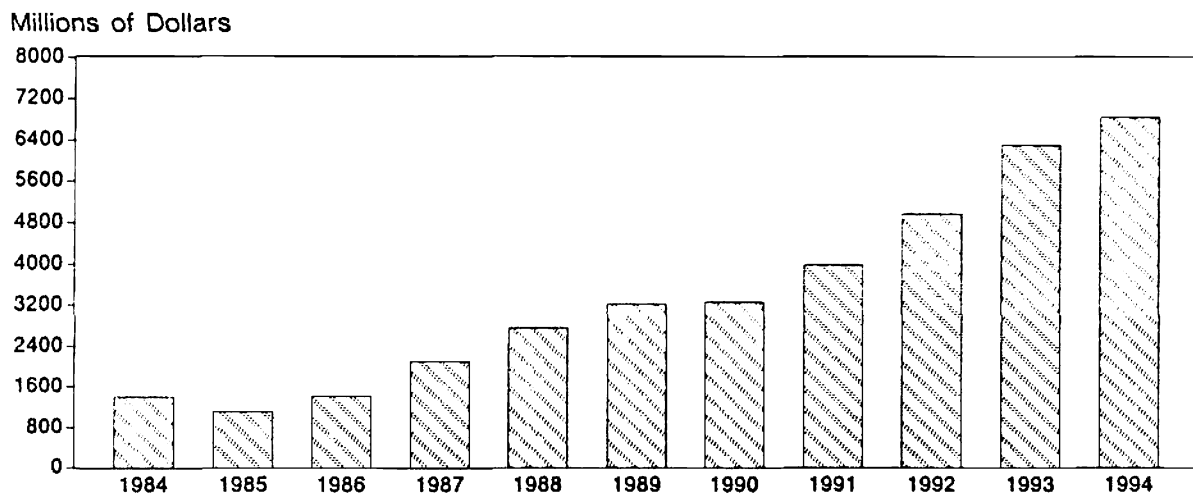
HIGHLIGHTS OF THE MOS MICROCONTROLLER FORECAST

Points worth noting about Dataquest's MOS microcontroller forecast include the following:

- Microcontroller revenue exceeded \$2.7 billion in 1988 and is expected to exceed \$3 billion in 1989, as shown in Figure 1.
- Unit shipments of 4-bit microcontrollers remain strong, with a forecast CAGR of 10.8 percent through 1994.
- Shipments of 8-bit microcontrollers still trail those of 4-bit microcontrollers this year, but the gap is narrowing.
- The market for 16-bit microcontrollers, other than the Ford engine controller, has been slow to materialize, but emerging applications, such as antiskid braking and recent product introductions, are expected to fuel growth in the next five years.
- Dataquest anticipates a mild downturn in overall semiconductor consumption beginning in mid-1989 and extending through mid-1990. However, both years are expected to show positive growth in microcomponent unit consumption. According to this industry model, the next cyclical downturn will occur in 1994.

Figure 1

Estimated Worldwide MOS Microcontroller Consumption
1984-1994



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Source: Dataquest
July 1989

Microcontroller Forecast Summary

COMPARISON WITH EARLIER FORECASTS

Dataquest has restated 16-bit microcontroller unit shipments for 1987 to include estimated shipments of the Intel-designed 8061 to Ford Motor Company. Previously, Dataquest considered this product to be a full-custom design for a single customer, and thus did not account for shipments of this product in the microcontroller totals. Although the product still is exclusive to Ford, the 8061 is now multiply sourced. To not include this product severely underestimates the 16-bit microcontroller market.

Microcontroller revenue for 1987 was reapportioned between 8-bit and 16-bit microcontrollers to account for this change, affecting the average selling prices (ASPs) of both product categories.

WORLDWIDE MOS MICROCONTROLLER FORECAST

Dataquest's MOS microcontroller forecast is presented in Tables 1 through 9. The tables included in this forecast are as follows:

Table 1	Worldwide MOS Microcontroller Revenue Forecast
Table 2	Worldwide MOS Microcontroller Unit Shipment Forecast
Table 3	Worldwide MOS Microcontroller ASP Forecast
Table 4	Estimated Worldwide MOS Microcontroller Revenue, 1979-1983
Table 5	Estimated Worldwide MOS Microcontroller Revenue, 1984-1988
Table 6	Estimated Worldwide MOS Microcontroller Unit Shipments, 1979-1983
Table 7	Estimated Worldwide MOS Microcontroller Unit Shipments, 1984-1988
Table 8	Estimated Worldwide MOS Microcontroller ASPs, 1979-1983
Table 9	Estimated Worldwide MOS Microcontroller ASPs, 1984-1988

Microcontroller Forecast Summary

Table 1

**Worldwide MOS Microcontroller Revenue Forecast
(Millions of Dollars)**

	<u>1989</u>	<u>1990</u>	<u>1991</u>	<u>1992</u>	<u>1993</u>	<u>1994</u>	<u>CAGR 1989-1994</u>
4-Bit MCU Growth	\$1,172.2 15.2%	\$1,183.4 1.0%	\$1,401.4 18.4%	\$1,608.8 14.8%	\$1,823.3 13.3%	\$1,910.4 4.8%	10.3%
8-Bit MCU Growth	\$2,001.0 18.6%	\$2,023.8 1.1%	\$2,521.1 24.6%	\$3,230.0 28.1%	\$4,237.5 31.2%	\$4,639.8 9.5%	18.3%
16-Bit MCU Growth	\$ 50.9 8.3%	\$ 52.8 3.8%	\$ 61.7 16.9%	\$ 134.3 117.5%	\$ 244.3 81.9%	\$ 300.6 23.0%	42.7%
Total Revenue Growth	\$3,224.0 17.2%	\$3,260.0 1.1%	\$3,984.2 22.2%	\$4,973.0 24.8%	\$6,305.1 26.8%	\$6,850.8 8.7%	16.3%

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

Source: Dataquest
July 1989

Table 2

**Worldwide MOS Microcontroller Unit Shipment Forecast
(Millions of Units)**

	<u>1989</u>	<u>1990</u>	<u>1991</u>	<u>1992</u>	<u>1993</u>	<u>1994</u>	<u>CAGR 1989-1994</u>
4-Bit MCU Growth	595.0 18.7%	610.0 2.5%	715.0 17.2%	825.0 15.4%	935.0 13.3%	995.0 6.4%	10.8%
8-Bit MCU Growth	575.0 26.4%	597.0 3.8%	735.0 23.1%	950.0 29.3%	1,250.0 31.6%	1,385.0 10.8%	19.2%
16-Bit MCU Growth	6.0 9.1%	6.3 5.0%	7.5 19.0%	18.0 140.0%	35.0 94.4%	45.0 28.6%	49.6%
Total Units Growth	1,176.0 22.3%	1,213.3 3.2%	1,457.5 20.1%	1,793.0 23.0%	2,220.0 23.8%	2,425.0 9.2%	15.6%

Source: Dataquest
July 1989

Microcontroller Forecast Summary

Table 3

Worldwide MOS Microcontroller ASP Forecast

	<u>1989</u>	<u>1990</u>	<u>1991</u>	<u>1992</u>	<u>1993</u>	<u>1994</u>	<u>CAGR</u> <u>1989-1994</u>
4-Bit MCU Growth	\$1.97 (3.0%)	\$1.94 (1.5%)	\$1.96 1.0%	\$1.95 (0.5%)	\$1.95 0	\$1.92 (1.5%)	(0.5%)
8-Bit MCU Growth	\$3.48 (6.2%)	\$3.39 (2.6%)	\$3.43 1.2%	\$3.40 (0.9%)	\$3.39 (0.3%)	\$3.35 (1.2%)	(0.8%)
16-Bit MCU Growth	\$8.48 (0.8%)	\$8.38 (1.2%)	\$8.23 (1.8%)	\$7.46 (9.4%)	\$6.98 (6.4%)	\$6.68 (4.3%)	(4.7%)
Aggregate ASP Growth	\$2.74 (4.2%)	\$2.69 (2.0%)	\$2.73 1.7%	\$2.77 1.5%	\$2.84 2.4%	\$2.83 (0.5%)	0.6%

Source: Dataquest
July 1989

Microcontroller Forecast Summary

Table 4

**Estimated Worldwide MOS Microcontroller Revenue
1979-1983
(Millions of Dollars)**

	<u>1979</u>	<u>1980</u>	<u>1981</u>	<u>1982</u>	<u>1983</u>	<u>CAGR 1979-1983</u>
4-Bit MCU Growth	\$110.4	\$206.6 87.1%	\$267.1 29.3%	\$253.0 (5.3%)	\$257.9 1.9%	23.6%
8-Bit MCU Growth	\$ 75.3	\$108.7 44.3%	\$136.2 25.3%	\$173.2 27.1%	\$267.3 54.4%	37.2%
16-Bit MCU Growth	\$ 0.05	\$ 0.15 200.0%	\$ 0.9 500.0%	\$ 0.9 (5.6%)	\$ 1.1 33.0%	118.1%
Total Revenue Growth	\$185.8	\$315.4 69.8%	\$404.2 28.2%	\$427.0 5.6%	\$526.3 23.3%	29.7%

Table 5

**Estimated Worldwide MOS Microcontroller Revenue
1984-1988
(Millions of Dollars)**

	<u>1984</u>	<u>1985</u>	<u>1986</u>	<u>1987</u>	<u>1988</u>	<u>CAGR 1984-1988</u>
4-Bit MCU Growth	\$ 475.8 84.5%	\$ 382.3 (19.6%)	\$ 554.7 45.1%	\$ 792.4 42.9%	\$1,017.2 28.4%	20.9%
8-Bit MCU Growth	\$ 930.3 248.1%	\$ 728.0 (21.7%)	\$ 853.4 17.2%	\$1,277.3 49.7%	\$1,687.3 32.1%	16.0%
16-Bit MCU Growth	\$ 0.7 (41.6%)	\$ 4.0 506.4%	\$ 7.0 74.7%	\$ 29.1 315.8%	\$ 47.0 61.8%	190.5%
Total Revenue Growth	\$1,406.7 167.3%	\$1,114.3 (20.8%)	\$1,415.1 27.0%	\$2,098.8 48.3%	\$2,751.6 31.1%	18.3%

Source: Dataquest
July 1989

Microcontroller Forecast Summary

Table 6

**Estimated Worldwide MOS Microcontroller Unit Shipments
1979-1983
(Millions of Units)**

	<u>1979</u>	<u>1980</u>	<u>1981</u>	<u>1982</u>	<u>1983</u>	<u>CAGR 1979-1983</u>
4-Bit MCU	50.5	96.1	133.5	158.2	171.9	35.8%
Growth	-	90.3%	38.9%	18.5%	8.7%	
8-Bit MCU	11.6	21.7	34.9	54.1	90.6	67.2%
Growth	-	87.6%	60.6%	55.0%	67.4%	
16-Bit MCU	0.001	0.005	0.04	0.05	0.09	208.0%
Growth	-	400.0%	700.0%	25.0%	80.0%	
Total						
Units	62.1	117.8	168.5	212.4	262.6	43.4%
Growth	-	89.8%	43.0%	26.1%	23.7%	

Table 7

**Estimated Worldwide MOS Microcontroller Unit Shipments
1984-1988
(Millions of Units)**

	<u>1984</u>	<u>1985</u>	<u>1986</u>	<u>1987</u>	<u>1988</u>	<u>CAGR 1984-1988</u>
4-Bit MCU	193.4	177.0	271.9	392.3	501.1	26.9%
Growth	12.5%	(8.5%)	53.6%	44.3%	27.7%	
8-Bit MCU	163.5	163.6	224.0	333.5	454.8	29.1%
Growth	80.5%	0.1%	36.9%	48.9%	36.4%	
16-Bit MCU	0.06	0.23	0.4	3.4	5.5	209.4%
Growth	(33.3%)	283.3%	73.9%	750.0%	61.8%	
Total						
Units	357.0	340.8	496.3	729.2	961.4	28.1%
Growth	35.9%	(4.5%)	45.6%	46.9%	31.8%	

Source: Dataquest
July 1989

Microcontroller Forecast Summary

Table 8

**Estimated Worldwide MOS Microcontroller ASPs
1979-1983**

	<u>1979</u>	<u>1980</u>	<u>1981</u>	<u>1982</u>	<u>1983</u>	<u>CAGR 1979-1983</u>
4-Bit MCU Growth	\$ 2.19	\$ 2.15 (1.6%)	\$ 2.00 (6.9%)	\$ 1.60 (20.1%)	\$ 1.50 (6.2%)	(9.0%)
8-Bit MCU Growth	\$ 6.50	\$ 5.00 (23.1%)	\$ 3.90 (22.0%)	\$ 3.20 (17.9%)	\$ 2.95 (7.8%)	(17.9%)
16-Bit MCU Growth	\$50.00	\$30.00 (40.0%)	\$22.50 (25.0%)	\$17.00 (24.4%)	\$12.56 (26.1%)	(29.2%)
Aggregate ASP Growth	\$ 2.99	\$ 2.68 (10.5%)	\$ 2.40 (10.4%)	\$ 2.01 (16.2%)	\$ 2.00 (0.3%)	(9.5%)

Table 9

**Estimated Worldwide MOS Microcontroller ASPs
1984-1988**

	<u>1984</u>	<u>1985</u>	<u>1986</u>	<u>1987</u>	<u>1988</u>	<u>CAGR 1984-1988</u>
4-Bit MCU Growth	\$ 2.46 64.0%	\$ 2.16 (12.2%)	\$ 2.04 (5.6%)	\$ 2.02 (1.0%)	\$2.03 0.5%	(4.7%)
8-Bit MCU Growth	\$ 5.69 92.9%	\$ 4.45 (21.8%)	\$ 3.81 (14.4%)	\$ 3.83 0.5%	\$3.71 (3.1%)	(10.1%)
16-Bit MCU Growth	\$11.00 (12.4%)	\$17.40 58.2%	\$17.48 0.5%	\$ 8.55 (51.1%)	\$8.55 0	(6.1%)
Aggregate ASP Growth	\$ 3.94 96.6%	\$ 3.27 (17.0%)	\$ 2.85 (12.8%)	\$ 2.88 0.9%	\$2.86 (0.6%)	(7.7%)

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Microcontroller Forecast Summary

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