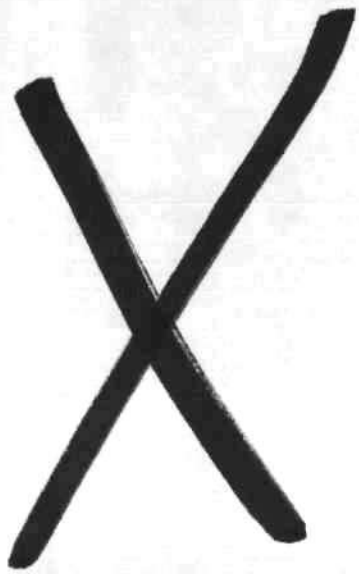


Appendix A — Market Estimate Worksheets

Table A-1

ESTIMATED WORLDWIDE SEMICONDUCTOR CONSUMPTION
(Dollars in Millions)

	1969	1970	1971	1972	1973	1974	1975	1976	1977
TOTAL SEMICONDUCTOR	2476	2575	2470	3047	4373	4949	3996	4755	6130
TOTAL I C	668	822	901	1227	1931	2286	1898	2362	3196
BIPOLAR DIGITAL	404	428	442	536	893	963	780	930	1149
TTL	177	172	226	340	638	714	578	678	809
DTL	141	149	115	97	120	110	80	72	63
ECL	28	52	61	57	65	72	72	105	152
OTHER	58	55	40	42	70	67	50	75	125
MOS	25	100	167	272	550	816	704	943	1378
PMOS	24	97	158	256	482	633	532	569	677
NMOS	0	0	2	4	13	72	83	193	417
CMOS	1	3	7	12	55	111	89	181	293
LINEAR	142	192	188	277	429	507	414	489	669
INTERFACE					72	88	76	88	115
CONTROL					140	165	140	156	203
ENTERTAINMENT					155	176	134	175	250
OTHER					62	78	64	70	101
HYBRID	97	102	104	142	59	0	0	0	0
TOTAL DISCRETE	1764	1711	1522	1725	2287	2472	1936	2185	2653
TRANSISTOR	869	863	795	900	1172	1267	993	1123	1328
SMALL SIGNAL	585	569	500	583	725	757	565	609	655
POWER	284	294	295	317	447	510	428	514	673
DIODE	642	608	502	567	697	738	595	660	818
SMALL SIGNAL	267	229	150	163	183	190	140	150	161
POWER	275	285	279	315	401	427	354	396	521
ZENER	100	94	73	89	113	121	101	114	136
THYRISTOR	119	124	110	123	190	224	186	219	286
OTHER	134	116	115	135	228	243	162	183	221
OPTOELECTRONIC	44	42	47	95	155	191	162	208	281

Source: DATAQUEST, Inc.

Appendix A — Market Estimate Worksheets

Table A-2

ESTIMATED NORTH AMERICAN SEMICONDUCTOR CONSUMPTION
(Dollars in Millions)

	1969	1970	1971	1972	1973	1974	1975	1976	1977
TOTAL SEMICONDUCTOR	1223	1106	1030	1277	1903	2199	1778	2087	2649
TOTAL I C	450	474	467	609	961	1191	1001	1176	1540
BIPOLAR DIGITAL	296	255	225	266	495	550	450	510	608
TTL									
DTL									
ECL									
OTHER									
MOS	17	68	88	131	269	416	365	453	649
PMOS									
NMOS									
CMOS									
LINEAR	57	68	75	114	197	225	186	213	283
INTERFACE									
CONTROL									
ENTERTAINMENT									
OTHER									
HYBRID	80	83	79	98	0	0	0	0	0
TOTAL DISCRETE	742	603	534	624	852	879	669	772	928
TRANSISTOR						459	344	399	471
SMALL SIGNAL						249	178	194	207
POWER						210	166	205	264
DIODE						252	201	228	274
SMALL SIGNAL						57	39	42	47
POWER						139	118	137	168
ZENER						56	44	49	59
THYRISTOR						92	75	87	115
OTHER						76	49	58	68
OPTOELECTRONIC	31	29	29	44	90	129	108	139	181

Source: DATAQUEST, Inc.

Appendix A — Market Estimate Worksheets

Table A-3

ESTIMATED JAPANESE SEMICONDUCTOR CONSUMPTION
(Dollars in Millions)

	1969	1970	1971	1972	1973	1974	1975	1976	1977
TOTAL SEMICONDUCTOR	533	763	670	872	1172	1157	931	1127	1472
TOTAL I C	113	199	214	310	440	435	356	489	696
BIPOLAR DIGITAL	50	90	86	86	100	95	77	102	141
TTL									
DTL									
ECL									
OTHER									
MOS	5	25	55	100	177	225	188	277	405
PMOS									
NMOS									
CMOS									
LINEAR	41	65	48	80	104	115	91	110	150
INTERFACE									
CONTROL									
ENTERTAINMENT									
OTHER									
HYBRID	17	19	25	44	59	0	0	0	0
TOTAL DISCRETE	418	560	449	526	688	685	542	598	722
TRANSISTOR						336	270	295	346
SMALL SIGNAL						217	166	179	193
POWER						119	104	116	153
DIODE						228	183	202	256
SMALL SIGNAL						63	47	49	52
POWER						148	122	137	184
ZENER						17	14	16	20
THYRISTOR						38	32	40	50
OTHER						83	57	61	70
OPTOELECTRONIC	2	4	7	36	44	37	33	40	54

Source: DATAQUEST, Inc.

Appendix A — Market Estimate Worksheets

Table ~~A-1~~

ESTIMATED EUROPEAN SEMICONDUCTOR CONSUMPTION
(Dollars in Millions)

	1969	1970	1971	1972	1973	1974	1975	1976	1977
TOTAL SEMICONDUCTOR	695	671	715	808	1153	1398	1126	1342	1740
TOTAL I C	100	139	205	283	479	590	485	621	849
BIPOLAR DIGITAL	55	77	122	170	263	279	229	285	355
TTL									
DTL									
ECL									
OTHER									
MOS	3	7	23	38	98	163	138	195	297
PMOS									
NMOS									
CMOS									
LINEAR	42	55	60	75	118	148	118	141	197
INTERFACE									
CONTROL									
ENTERTAINMENT									
OTHER									
HYBRID	0	0	0	0	0	0	0	0	0
TOTAL DISCRETE	584	523	499	512	657	788	624	697	852
TRANSISTOR						404	322	363	427
SMALL SIGNAL						~~256~~	~~194~~	207	222
POWER						~~148~~	~~128~~	156	~~205~~
DIODE						228	183	196	244
SMALL SIGNAL						~~60~~	~~46~~	~~49~~	50
POWER						~~123~~	~~99~~	105	~~145~~
ZENER						~~45~~	~~38~~	~~42~~	~~49~~
THYRISTOR						82	70	81	107
OTHER						74	49	57	74
OPTOELECTRONIC	11	9	11	13	17	20	17	24	39

Source: DATAQUEST, Inc.

Appendix A — Market Estimate Worksheets

Table A-5

ESTIMATED REST OF WORLD SEMICONDUCTOR CONSUMPTION
(Dollars in Millions)

	1969	1970	1971	1972	1973	1974	1975	1976	1977
TOTAL SEMICONDUCTOR	25	35	55	90	145	195	161	199	269
TOTAL I C	5	10	15	25	51	70	56	76	111
BIPOLAR DIGITAL	3	6	9	14	35	39	24	33	45
TTL									
DTL									
ECL									
OTHER									
MOS	0	0	1	3	6	12	13	18	27
PMOS									
NMOS									
CMOS									
LINEAR	2	4	5	8	10	19	19	25	39
INTERFACE									
CONTROL									
ENTERTAINMENT									
OTHER									
HYBRID	0	0	0	0	0	0	0	0	0
TOTAL DISCRETE	20	25	40	63	90	120	101	118	151
TRANSISTOR						68	57	66	84
SMALL SIGNAL						35	27	29	33
POWER						33	30	37	51
DIODE						30	28	34	44
SMALL SIGNAL						10	8	10	12
POWER						17	15	17	24
ZENER						3	5	7	8
THYRISTOR						12	9	11	14
OTHER						10	7	7	9
OPTOELECTRONIC	0	0	0	2	4	5	4	5	7

Source: DATAQUEST, Inc.

Appendix A — Market Estimate Worksheets

Table A-6

ESTIMATED WORLDWIDE SEMICONDUCTOR FACTORY SHIPMENTS
(Dollars in Millions)

	1969	1970	1971	1972	1973	1974	1975	1976	1977
TOTAL SEMICONDUCTOR	2476	2575	2470	3047	4373	4949	3996	4755	6130
TOTAL I C	668	822	901	1227	1931	2286	1898	2362	3196
BIPOLAR DIGITAL	404	428	442	536	893	963	780	930	1149
TTL	177	172	226	340	638	714	578	678	809
DTL	141	149	115	97	120	110	80	72	63
ECL	28	52	61	57	65	72	72	105	152
OTHER	58	55	40	42	70	67	50	75	125
MOS	25	100	167	272	550	816	704	943	1378
PMOS	24	97	158	256	482	633	532	569	677
NMOS	0	0	2	4	13	72	83	193	417
CMOS	1	3	7	12	55	111	89	181	293
LINEAR	142	192	188	277	429	507	414	489	669
INTERFACE					72	88	76	88	115
CONTROL					140	165	140	156	203
ENTERTAINMENT					155	176	134	175	250
OTHER					62	78	64	70	101
HYBRID	97	102	104	142	59	0	0	0	0
TOTAL DISCRETE	1764	1711	1522	1725	2287	2472	1936	2185	2653
TRANSISTOR	869	863	795	900	1172	1267	993	1123	1328
SMALL SIGNAL	585	569	500	583	725	757	565	609	655
POWER	284	294	295	317	447	510	428	514	673
DIODE	642	608	502	567	697	738	595	660	818
SMALL SIGNAL	267	229	150	163	183	190	140	150	161
POWER	275	285	279	315	401	427	354	396	521
ZENER	100	94	73	89	113	121	101	114	136
THYRISTOR	119	124	110	123	190	224	186	219	286
OTHER	134	116	115	135	228	243	162	183	221
OPTOELECTRONIC	44	42	47	95	155	191	162	208	281

Source: DATAQUEST, Inc.

Appendix A — Market Estimate Worksheets

Table A-7

ESTIMATED NORTH AMERICAN SEMICONDUCTOR FACTORY SHIPMENTS
(Dollars in Millions)

	1969	1970	1971	1972	1973	1974	1975	1976	1977
TOTAL SEMICONDUCTOR	1327	1211	1157	1486	2080	2382			
TOTAL I C	498	524	534	738	1123	1368			
BIPOLAR DIGITAL	326	287	263	342	546	568			
TTL	142	115	134	222	403	432			
DTL	114	100	69	63	61	49			
ECL	23	35	39	38	48	56			
OTHER	47	37	21	19	34	31			
MOS	21	75	101	165	352	562			
PMOS	20	72	93	152	292	402			
NMOS	0	0	2	4	12	66			
CMOS	1	3	6	9	48	94			
LINEAR	71	79	91	133	225	238			
INTERFACE									
CONTROL									
ENTERTAINMENT									
OTHER									
HYBRID	80	83	79	98	0	0			
TOTAL DISCRETE	792	653	587	678	852	873			
TRANSISTOR	363	290	303	358	445	453			
SMALL SIGNAL	233	175	178	208	215	213			
POWER	130	115	125	150	230	240			
DIODE	307	256	189	210	241	232			
SMALL SIGNAL	143	104	51	47	43	34			
POWER	108	101	102	119	144	155			
ZENER	56	51	36	44	54	43			
THYRISTOR	63	60	54	64	95	102			
OTHER	59	47	41	46	71	86			
OPTOELECTRONIC	37	34	36	70	105	141			

Source: DATAQUEST, Inc.

Appendix A — Market Estimate Worksheets

Table A-8

ESTIMATED JAPANESE SEMICONDUCTOR FACTORY SHIPMENTS
(Dollars in Millions[1])

	1969	1970	1971	1972	1973	1974	1975	1976	1977
TOTAL SEMICONDUCTOR	506	777	671	823	1151	1115			
TOTAL I C	87	178	174	241	376	359			
BIPOLAR DIGITAL	37	81	63	50	83	95			
TTL									
DTL									
ECL									
OTHER									
MOS	3	20	51	82	143	144			
PMOS	3	20	50	80	138	130			
NMOS	0	0	0	0	1	4			
CMOS	0	0	1	2	4	10			
LINEAR	30	58	35	65	91	120			
INTERFACE									
CONTROL									
ENTERTAINMENT									
OTHER									
HYBRID	17	19	25	44	59	0			
TOTAL DISCRETE	419	596	492	565	740	724			
TRANSISTOR	244	353	287	329	429	414			
SMALL SIGNAL	162	239	182	229	309	289			
POWER	82	114	105	100	120	125			
DIODE	139	194	167	196	243	241			
SMALL SIGNAL	53	70	48	62	75	67			
POWER	76	109	107	119	148	149			
ZENER	10	15	12	15	20	25			
THYRISTOR	23	35	26	25	43	45			
OTHER	13	14	12	15	25	24			
OPTOELECTRONIC	0	3	5	17	35	32			

Source: DATAQUEST, Inc.

Appendix A — Market Estimate Worksheets

Table A-9

ESTIMATED EUROPEAN SEMICONDUCTOR FACTORY SHIPMENTS
(Dollars in Millions)

	1969	1970	1971	1972	1973	1974	1975	1976	1977
TOTAL SEMICONDUCTOR	633	575	625	710	1093	1344			
TOTAL I C	83	120	191	243	423	511			
BIPOLAR DIGITAL	41	60	114	139	256	270			
TTL									
DTL									
ECL									
OTHER									
MOS	1	5	15	25	55	110			
PMOS	1	5	15	24	52	101			
NMOS	0	0	0	0	0	2			
CMOS	0	0	0	1	3	7			
LINEAR	41	55	62	79	112	131			
INTERFACE									
CONTROL									
ENTERTAINMENT									
OTHER									
HYBRID	0	0	0	0	0	0			
TOTAL DISCRETE	543	450	428	459	655	815			
TRANSISTOR	256	212	195	198	267	355			
SMALL SIGNAL	184	147	130	131	170	210			
POWER	72	65	65	67	97	145			
DIODE	192	154	141	153	204	250			
SMALL SIGNAL	67	51	46	46	56	74			
POWER	91	75	70	77	109	123			
ZENER	34	28	25	30	39	53			
THYRISTOR	33	29	30	34	52	77			
OTHER	62	55	62	74	132	133			
OPTOELECTRONIC	7	5	6	8	15	18			

Source: DATAQUEST, Inc.

Appendix A — Market Estimate Worksheets

Table A-10

ESTIMATED REST OF WORLD SEMICONDUCTOR FACTORY SHIPMENTS
(Dollars in Millions)

	1969	1970	1971	1972	1973	1974	1975	1976	1977
TOTAL SEMICONDUCTOR	10	12	17	28	49	108			
TOTAL I C	0	0	2	5	9	48			
BIPOLAR DIGITAL									
TTL									
DTL									
ECL									
OTHER									
MOS	0	0	0	0	0	0			
PMOS	0	0	0	0	0	0			
NMOS	0	0	0	0	0	0			
CMOS	0	0	0	0	0	0			
LINEAR	0	0	0	0	1	18			
INTERFACE									
CONTROL									
ENTERTAINMENT									
OTHER									
HYBRID	0	0	0	0	0	0			
TOTAL DISCRETE	10	12	15	23	40	60			
TRANSISTOR	6	8	10	15	31	45			
SMALL SIGNAL	6	8	10	15	31	45			
POWER	0	0	0	0	0	0			
DIODE	4	4	5	8	9	15			
SMALL SIGNAL	4	4	5	8	9	15			
POWER	0	0	0	0	0	0			
ZENER	0	0	0	0	0	0			
THYRISTOR	0	0	0	0	0	0			
OTHER	0	0	0	0	0	0			
OPTOELECTRONIC	0	0	0	0	0	0			

Source: DATAQUEST, Inc.

1976

Appendix A — Market Estimate Worksheets

Table A-1

ESTIMATED WORLDWIDE SEMICONDUCTOR CONSUMPTION
(Dollars in Millions)

	1972	1973	1974	1975	1976	1977	1978	1979	1980
TOTAL SEMICONDUCTOR	3093	4480	5093	4130	4956	6542	7682	6948	8314
TOTAL I C	1231	1949	2374	1950	2418	3312	4009	3516	4359
BIPOLAR DIGITAL	540	888	972	707	828	1106	1235	1028	1231
TTL	344	645	725	520	598	818	892	705	839
DTL	97	117	108	83	84	81	76	65	55
ECL	57	64	72	53	73	98	116	108	132
OTHER	42	62	67	51	73	109	151	150	205
MOS	272	573	877	833	1074	1504	1910	1719	2167
PMOS	256	505	694	605	698	896	1019	878	994
NMOS	4	13	72	133	240	421	665	645	926
CMOS	12	55	111	95	136	187	226	196	247
LINEAR	277	429	525	410	516	702	864	769	961
INTERFACE	47	72	91	74	84	132	161	139	164
CONTROL	90	140	171	138	192	255	334	301	409
ENTERTAINMENT	100	155	182	134	162	212	248	222	260
OTHER	40	62	81	64	78	103	121	107	128
HYBRID	142	59	0	0	0	0	0	0	0
TOTAL DISCRETE	1765	2376	2534	1992	2305	2911	3289	3098	3560
TRANSISTOR	900	1210	1279	1033	1187	1508	1689	1565	1814
SMALL SIGNAL	583	744	769	565	640	787	847	765	870
POWER	317	466	510	468	547	721	842	800	944
DIODE	567	742	788	624	730	910	1036	1009	1139
SMALL SIGNAL	163	213	230	168	188	233	261	230	257
POWER	315	416	427	355	428	537	620	645	727
ZENER	89	113	131	101	114	140	155	134	155
THYRISTOR	123	195	224	169	197	252	292	277	324
OTHER	175	229	243	166	191	241	272	247	283
OPTOELECTRONIC	97	155	185	188	233	319	384	334	395

Source: DATAQUEST, Inc.

Appendix A — Market Estimate Worksheets

Table A-3

ESTIMATED JAPANESE SEMICONDUCTOR CONSUMPTION
(Dollars in Millions)

	1972	1973	1974	1975	1976	1977	1978	1979	1980
TOTAL SEMICONDUCTOR	872	1178	1227	977	1155	1515	1775	1607	1936
TOTAL I C	310	436	487	411	494	685	841	752	951
BIPOLAR DIGITAL	86	100	131	120	137	188	221	192	237
TTL									
DTL									
ECL									
OTHER									
MOS	100	177	241	201	247	348	438	397	508
PMOS									
NMOS									
CMOS									
LINEAR	80	100	115	90	110	149	182	163	206
INTERFACE									
CONTROL									
ENTERTAINMENT									
OTHER									
HYBRID	44	59	0	0	0	0	0	0	0
TOTAL DISCRETE	526	698	703	534	621	775	867	796	917
TRANSISTOR			346	280	323	404	447	404	473
SMALL SIGNAL			227	159	184	221	234	206	237
POWER			119	121	139	183	213	198	236
DIODE			236	175	207	255	286	270	302
SMALL SIGNAL			70	53	61	74	81	71	80
POWER			140	104	126	157	179	176	197
ZENER			26	18	20	24	26	23	25
THYRISTOR			38	32	37	48	57	53	63
OTHER			83	47	54	68	77	69	79
OPTOELECTRONIC	36	44	37	32	40	55	67	59	68

Source: DATAQUEST, Inc.

Appendix A — Market Estimate Worksheets

Table A-4

ESTIMATED EUROPEAN SEMICONDUCTOR CONSUMPTION
(Dollars in Millions)

	1972	1973	1974	1975	1976	1977	1978	1979	1980
TOTAL SEMICONDUCTOR	842	1215	1401	1135	1323	1741	2023	1854	2217
TOTAL I C	287	482	544	457	547	761	918	824	1037
BIPOLAR DIGITAL	174	263	229	189	215	291	320	268	324
TTL									
DTL									
ECL									
OTHER									
MOS	38	101	168	158	197	285	372	353	458
PMOS									
NMOS									
CMOS									
LINEAR	75	118	147	110	135	185	226	203	255
INTERFACE									
CONTROL									
ENTERTAINMENT									
OTHER									
HYBRID	0	0	0	0	0	0	0	0	0
TOTAL DISCRETE	542	716	834	653	744	935	1050	981	1121
TRANSISTOR			432	344	388	489	547	504	581
SMALL SIGNAL			281	210	233	286	309	278	317
POWER			151	134	155	203	238	226	264
DIODE			234	190	219	273	305	294	332
SMALL SIGNAL			64	46	51	64	70	63	69
POWER			121	106	127	159	179	183	207
ZENER			49	38	41	50	56	48	56
THYRISTOR			93	68	79	99	115	107	122
OTHER			75	51	58	74	83	76	86
OPTOELECTRONIC	13	17	23	25	32	45	55	49	59

Source: DATAQUEST, Inc.

Appendix A — Market Estimate Worksheets

Table A-5

ESTIMATED REST OF WORLD SEMICONDUCTOR CONSUMPTION
(Dollars in Millions)

	1972	1973	1974	1975	1976	1977	1978	1979	1980
TOTAL SEMICONDUCTOR	90	155	234	232	306	424	541	542	654
TOTAL I C	25	51	82	90	129	186	254	243	302
BIPOLAR DIGITAL	14	35	42	30	36	46	55	55	66
TTL									
DTL									
ECL									
OTHER									
MOS	3	6	22	44	69	103	148	141	175
PMOS									
NMOS									
CMOS									
LINEAR	8	10	18	16	24	37	51	47	61
INTERFACE									
CONTROL									
ENTERTAINMENT									
OTHER									
HYBRID	0	0	0	0	0	0	0	0	0
TOTAL DISCRETE	63	100	138	117	142	188	227	244	287
TRANSISTOR			79	62	76	102	117	120	137
SMALL SIGNAL			40	27	33	45	51	53	56
POWER			39	35	43	57	66	67	81
DIODE			37	36	43	57	78	91	106
SMALL SIGNAL			20	16	16	21	29	25	28
POWER			14	18	21	29	41	59	69
ZENER			3	2	6	7	8	7	9
THYRISTOR			12	9	10	13	14	16	23
OTHER			10	10	13	16	18	17	21
OPTOELECTRONIC	2	4	14	25	35	50	60	55	65

Source: DATAQUEST, Inc.

Appendix A — Market Estimate Worksheets

Table A-6

ESTIMATED WORLDWIDE SEMICONDUCTOR FACTORY SHIPMENTS
(Dollars in Millions)

	1969	1970	1971	1972	1973	1974	1975
TOTAL SEMICONDUCTOR	2476	2596	2494	3093	4480	5093	4130
TOTAL I C	668	823	904	1231	1949	2374	1950
BIPOLAR DIGITAL	404	429	445	540	888	972	707
TTL	177	173	229	344	645	725	520
DTL	141	149	115	97	117	108	83
ECL	28	52	61	57	64	72	53
OTHER	58	55	40	42	62	67	51
MOS	25	100	167	272	573	877	833
PMOS	24	97	158	256	505	694	605
NMOS	0	0	2	4	13	72	133
CMOS	1	3	7	12	55	111	95
LINEAR	142	192	188	277	429	525	410
INTERFACE					72	91	74
CONTROL					140	171	138
ENTERTAINMENT					155	182	134
OTHER					62	81	64
HYBRID	97	102	104	142	59	0	0
TOTAL DISCRETE	1764	1731	1542	1765	2376	2534	1992
TRANSISTOR	869	863	795	900	1210	1279	1033
SMALL SIGNAL	585	569	500	583	744	769	565
POWER	284	294	295	317	466	510	468
DIODE	642	608	502	567	742	788	624
SMALL SIGNAL	267	229	150	163	213	230	168
POWER	275	285	279	315	416	427	355
ZENER	100	94	73	89	113	131	101
THYRISTOR	119	124	110	123	195	224	169
OTHER	134	136	135	175	229	243	166
OPTOELECTRONIC	44	42	48	97	155	185	188

Source: DATAQUEST, Inc.

Appendix A — Market Estimate Worksheets

Table A-7

ESTIMATED NORTH AMERICAN SEMICONDUCTOR FACTORY SHIPMENTS
(Dollars in Millions)

	1969	1970	1971	1972	1973	1974	1975
TOTAL SEMICONDUCTOR	1327	1211	1157	1486	2185	2574	2096
TOTAL I C	498	524	534	738	1193	1471	1195
BIPOLAR DIGITAL	326	287	263	342	556	594	430
TTL	142	116	135	224	428	469	331
DTL	114	100	69	63	61	49	43
ECL	23	34	38	36	41	45	31
OTHER	47	37	21	19	26	31	25
MOS	21	75	101	165	392	592	533
PMOS	20	72	93	152	332	432	348
NMOS	0	0	2	4	12	66	108
CMOS	1	3	6	9	48	94	77
LINEAR	71	79	91	133	245	285	232
INTERFACE							
CONTROL							
ENTERTAINMENT							
OTHER							
HYBRID	80	83	79	98	0	0	0
TOTAL DISCRETE	792	653	587	678	882	967	775
TRANSISTOR	363	290	303	358	440	468	376
SMALL SIGNAL	233	175	178	208	230	243	179
POWER	130	115	125	150	210	225	197
DIODE	307	256	189	210	276	311	256
SMALL SIGNAL	143	104	51	47	63	76	63
POWER	108	101	102	119	159	172	141
ZENER	56	51	36	44	54	63	52
THYRISTOR	63	60	54	64	95	102	75
OTHER	59	47	41	46	71	86	68
OPTOELECTRONIC	37	34	36	70	110	136	126

Source: DATAQUEST, Inc.

Appendix A — Market Estimate Worksheets

Table A-8

ESTIMATED JAPANESE SEMICONDUCTOR FACTORY SHIPMENTS
(Dollars in Millions[1])

	1969	1970	1971	1972	1973	1974	1975
TOTAL SEMICONDUCTOR	506	777	671	823	1150	1108	904
TOTAL I C	87	178	174	241	374	366	357
BIPOLAR DIGITAL	37	81	63	50	82	105	80
TTL							
DTL							
ECL							
OTHER							
MOS	3	20	51	82	142	156	187
PMOS	3	20	50	80	137	142	155
NMOS	0	0	0	0	1	4	19
CMOS	0	0	1	2	4	10	13
LINEAR	30	58	35	65	91	105	90
INTERFACE							
CONTROL							
ENTERTAINMENT							
OTHER							
HYBRID	17	19	25	44	59	0	0
TOTAL DISCRETE	419	596	492	565	749	721	522
TRANSISTOR	244	353	287	329	438	411	311
SMALL SIGNAL	162	239	182	229	318	286	196
POWER	82	114	105	100	120	125	115
DIODE	139	194	167	196	243	241	171
SMALL SIGNAL	53	70	48	62	75	67	40
POWER	76	109	107	119	148	149	113
ZENER	10	15	12	15	20	25	18
THYRISTOR	23	35	26	25	43	45	30
OTHER	13	14	12	15	25	24	10
OPTOELECTRONIC	0	3	5	17	27	21	25

Source: DATAQUEST, Inc.

Appendix A — Market Estimate Worksheets

Table A-9

ESTIMATED EUROPEAN SEMICONDUCTOR FACTORY SHIPMENTS
(Dollars in Millions)

	1969	1970	1971	1972	1973	1974	1975
TOTAL SEMICONDUCTOR	633	596	649	756	1084	1295	1020
TOTAL I C	83	121	194	247	373	486	353
BIPOLAR DIGITAL	41	61	117	143	242	243	173
TTL							
DTL							
ECL							
OTHER							
MOS	1	5	15	25	39	126	108
PMOS	1	5	15	24	36	117	97
NMOS	0	0	0	0	0	2	6
CMOS	0	0	0	1	3	7	5
LINEAR	41	55	62	79	92	117	72
INTERFACE							
CONTROL							
ENTERTAINMENT							
OTHER							
HYBRID	0	0	0	0	0	0	0
TOTAL DISCRETE	543	470	448	499	695	786	642
TRANSISTOR	256	212	195	198	291	355	306
SMALL SIGNAL	184	147	130	131	155	195	150
POWER	72	65	65	67	136	160	156
DIODE	192	154	141	153	214	221	184
SMALL SIGNAL	67	51	46	46	66	72	52
POWER	91	75	70	77	109	106	101
ZENER	34	28	25	30	39	43	31
THYRISTOR	33	29	30	34	57	77	64
OTHER	62	75	82	114	133	133	88
OPTOELECTRONIC	7	5	7	10	16	23	25

Source: DATAQUEST, Inc.

Table A-10

ESTIMATED REST OF WORLD SEMICONDUCTOR FACTORY SHIPMENTS
(Dollars in Millions)

	1969	1970	1971	1972	1973	1974	1975	
TOTAL SEMICONDUCTOR	10	12	17	28	61	116	110	
TOTAL I C	0	0	2	5	9	51	45	
BIPOLAR DIGITAL	0	0	2	5	8	30	24	34
TTL	0	0						
DTL	0	0						
ECL	0	0						
OTHER	0	0						
MOS	0	0	0	0	0	3	5	7
PMOS	0	0	0	0	0	3	5	
NMOS	0	0	0	0	0	0	0	
CMOS	0	0	0	0	0	0	0	
LINEAR	0	0	0	0	1	18	16	18
INTERFACE	0	0	0	0				
CONTROL	0	0	0	0				
ENTERTAINMENT	0	0	0	0				
OTHER	0	0	0	0				
HYBRID	0	0	0	0	0	0	0	
TOTAL DISCRETE	10	12	15	23	50	60	53	
TRANSISTOR	6	8	10	15	41	45	40	
SMALL SIGNAL	6	8	10	15	41	45	40	
POWER	0	0	0	0	0	0	0	
DIODE	4	4	5	8	9	15	13	
SMALL SIGNAL	4	4	5	8	9	15	13	
POWER	0	0	0	0	0	0	0	
ZENER	0	0	0	0	0	0	0	
THYRISTOR	0	0	0	0	0	0	0	
OTHER	0	0	0	0	0	0	0	
OPTOELECTRONIC	0	0	0	0	2	5	12	

Source: DATAQUEST, Inc.

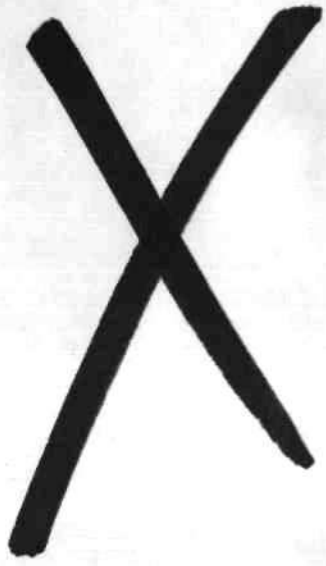
Appendix A — Market Estimate Worksheets

Table A-11

ESTIMATED WORLDWIDE SEMICONDUCTOR CONSUMPTION
(Units in Millions)

	1969	1970	1971	1972	1973	1974	1975	1976	1977
TOTAL SEMICONDUCTOR	6695	7018	7641	10255	15683	17114	14270	16878	18729
TOTAL I C	491	619	805	1288	2179	2350	2055	2608	3688
BIPOLAR DIGITAL	269	361	511	761	1306	1568	1285	1592	2304
TTL	92	126	290	491	977	1229	1020	1272	1948
DTL	118.5	167.4	164.3	198.0	243.8	220.4	162.7	152.7	135.0
ECL	9.7	19.7	23.0	23.4	34.4	59.0	54.1	89.0	136.1
OTHER	49.2	46.2	34.2	43.3	53.0	54.9	52.0	91.2	139.7
MOS	2.8	13.9	22.5	44.9	126.4	218.0	303.4	408.2	557.5
PMOS	2.7	13.6	21.3	41.2	85.4	128.5	151.6	166.2	206.5
NMOS			.20	.70	4.30	14.49	29.95	53.10	83.86
CMOS	.1	.3	1.0	3.0	36.7	75.0	121.8	188.9	267.1
LINEAR	67.0	109.1	132.4	263.8	451.6	564.5	465.9	607.1	825.9
INTERFACE					50.3	68.9	62.2	77.1	120.0
CONTROL					130.8	176.3	153.3	220.7	303.6
ENTERTAINMENT					206.7	256.3	197.1	241.8	316.4
OTHER					63.3	85.3	71.9	89.7	119.8
HYBRID	151.6	136.0	138.7	218.5	295.0				
TOTAL DISCRETE	6195	6386	6817	8893	13379	14591	12009	14009	14671
TRANSISTOR	2318	2295	2375	3267	4702	5204	4455	5413	6766
SMALL SIGNAL	2089	2032	2083	2915	4133	4524	3767	4571	5621
POWER	229	262	292	352	568	680	688	842	1144
DIODE	3783	3982	4282	5381	8206	8917	7161	8087	7221
SMALL SIGNAL	2670	2862	3000	3260	5325	5750	4200	4700	5825
POWER	917	919	1073	1750	2447	2512	2367	2675	463
ZENER	196.1	200.0	208.6	370.8	513.6	655.0	594.1	712.5	933.3
THYRISTOR	77.3	92.5	94.0	128.1	221.6	276.5	234.7	298.5	400.0
OTHER	16.2	17.0	65.9	116.7	169.6	194.4	158.1	209.9	283.5
OPTOELECTRONIC	10.0	12.0	19.4	74.6	126.0	172.9	206.6	261.8	370.9

Source: DATAQUEST, Inc.



1977

Appendix A—Market Estimate Worksheets

Table A-2

ESTIMATED NORTH AMERICAN SEMICONDUCTOR CONSUMPTION
(Dollars in Millions)

	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
TOTAL SEMICONDUCTOR	1285	1964	2270	1818	2362	3017	3473	3071	3759	4411
TOTAL I C	588	989	1260	1018	1414	1865	2161	1850	2339	2726
BIPOLAR DIGITAL	264	510	573	362	488	631	702	564	674	802
TTL										
DTL										
ECL										
OTHER										
MOS	135	278	442	432	650	872	1020	894	1186	1403
PMOS										
NMOS										
CMOS										
LINEAR	190	201	245	224	276	362	439	392	479	521
INTERFACE										
CONTROL										
ENTERTAINMENT										
OTHER										
HYBRID	0	0	0	0	0	0	0	0	0	0
TOTAL DISCRETE	634	872	888	672	797	978	1110	1032	1199	1426
TRANSISTOR			431	347	407	513	578	537	623	736
SMALL SIGNAL			230	169	197	235	253	228	260	305
POWER			201	178	210	278	325	309	363	431
DIODE			301	223	270	325	367	341	399	478
SMALL SIGNAL			96	53	67	74	81	71	80	96
POWER			152	127	156	192	221	214	254	304
ZENER			53	43	47	59	65	56	65	78
THYRISTOR			81	60	80	92	106	101	116	139
OTHER			75	42	40	48	59	53	61	73
OPTOELECTRONIC	62	103	122	128	151	174	202	189	221	259
LED LAMPS	8	11	12	13	18	19	24	21	23	28
LED DISPLAYS	38	72	84	86	94	109	123	117	139	165
COUPLERS	5	10	13	13	17	22	28	26	30	34
OTHER	11	10	13	16	22	24	27	25	29	32

Source: DATAQUEST, Inc.

Appendix A—Market Estimate Worksheets

Table A-3

ESTIMATED JAPANESE SEMICONDUCTOR CONSUMPTION
(Dollars in Millions)

	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
TOTAL SEMICONDUCTOR	856	1158	1276	1001	1587	1899	2187	1960	2331	2559
TOTAL I C	305	432	535	447	729	919	1077	951	1185	1396
BIPOLAR DIGITAL	86	100	131	100	158	208	243	217	267	314
TTL										
DTL										
ECL										
OTHER										
MOS	100	177	241	201	291	390	486	447	566	675
PMOS										
NMOS										
CMOS										
LINEAR	119	155	163	146	280	321	348	287	352	407
INTERFACE										
CONTROL										
ENTERTAINMENT										
OTHER										
HYBRID	0	0	0	0	0	0	0	0	0	0
TOTAL DISCRETE	526	698	708	517	799	908	1027	930	1056	1063
TRANSISTOR			412	308	446	493	541	487	550	611
SMALL SIGNAL			293	187	295	310	328	289	314	338
POWER			119	121	151	183	213	198	236	273
DIODE			241	166	271	315	357	328	369	294
SMALL SIGNAL			94	70	88	97	108	97	106	0
POWER			121	78	158	189	216	202	229	254
ZENER			26	18	25	29	33	29	34	40
THYRISTOR			38	29	51	64	88	79	95	110
OTHER			17	14	31	36	41	36	42	48
OPTOELECTRONIC	25	28	33	37	59	72	83	79	90	100
LED LAMPS	2	4	4	5	6	8	10	9	10	12
LED DISPLAYS	9	13	15	16	18	23	28	27	32	37
COUPLERS	1	2	3	3	4	5	6	6	9	10
OTHER	13	9	11	13	31	36	39	37	39	41

Source: DATAQUEST, Inc.

Appendix A--Market Estimate Worksheets

Table A-6

ESTIMATED WORLDWIDE SEMICONDUCTOR FACTORY SHIPMENTS
(Dollars in Millions)

	1969	1970	1971	1972	1973	1974	1975	1976
TOTAL SEMICONDUCTOR	2476	2626	2540	3148	4616	5373	4348	5762
TOTAL I C	668	827	913	1245	1986	2495	2097	2936
BIPOLAR DIGITAL	402	423	455	538	908	975	672	903
TTL	175	175	233	349	648	719	496	719
DTL	141	149	116	98	118	101	81	71
ECL	28	53	62	58	65	73	55	76
OTHER	58	46	44	33	77	82	40	37
MOS	30	100	162	276	562	873	835	1228
PMOS	29	97	153	260	494	690	607	649
NMOS	0	0	2	4	13	72	133	377
CMOS	1	3	7	12	55	111	95	202
LINEAR	236	304	296	431	516	647	590	805
INTERFACE				47	72	91	74	89
CONTROL				190	200	251	240	322
ENTERTAINMENT				100	152	182	162	251
OTHER				94	92	123	114	143
HYBRID	0	0	0	0	0	0	0	0
TOTAL DISCRETE	1764	1749	1574	1796	2465	2681	2034	2546
TRANSISTOR	869	878	828	938	1307	1388	1068	1318
SMALL SIGNAL	585	574	518	597	812	855	626	779
POWER	284	304	310	341	495	533	442	539
DIODE	692	665	558	642	846	941	707	888
SMALL SIGNAL	287	255	176	206	277	322	211	272
POWER	305	316	309	347	456	481	396	499
ZENER	100	94	73	89	113	138	100	117
THYRISTOR	119	123	110	123	195	231	180	231
OTHER	84	83	78	93	117	121	79	109
OPTOELECTRONIC	44	50	53	107	165	197	217	280
LED LAMPS		6	6	15	22	23	29	40
LED DISPLAYS		13	21	55	102	120	125	141
COUPLERS		1	2	7	15	21	22	30
OTHER		30	24	30	26	33	41	69

Source: DATAQUEST, Inc.

Appendix A—Market Estimate Worksheets

Table A-7

ESTIMATED NORTH AMERICAN SEMICONDUCTOR FACTORY SHIPMENTS
(Dollars in Millions)

	1969	1970	1971	1972	1973	1974	1975	1976
TOTAL SEMICONDUCTOR	1327	1210	1161	1498	2209	2626	2132	2713
TOTAL I C	498	524	537	749	1192	1495	1221	1637
BIPOLAR DIGITAL	326	287	263	342	556	594	400	519
TTL	142	116	135	224	428	469	308	429
DTL	114	100	69	63	61	49	43	41
ECL	23	34	38	36	41	45	33	39
OTHER	47	37	21	19	26	31	16	10
MOS	21	75	101	169	383	592	538	798
PMOS	20	72	93	156	323	432	353	332
NMOS	0	0	2	4	12	66	108	304
CMOS	1	3	6	9	48	94	77	162
LINEAR	151	162	173	238	253	309	283	320
INTERFACE								
CONTROL								
ENTERTAINMENT								
OTHER								
HYBRID	0	0	0	0	0	0	0	0
TOTAL DISCRETE	792	653	587	678	896	987	759	895
TRANSISTOR	363	290	303	358	440	468	376	425
SMALL SIGNAL	233	175	178	208	230	243	179	214
POWER	130	115	125	150	210	225	197	211
DIODE	307	256	189	210	286	331	256	303
SMALL SIGNAL	143	104	51	47	73	96	63	81
POWER	108	101	102	119	159	172	141	167
ZENER	56	51	36	44	54	63	52	55
THYRISTOR	63	60	54	64	95	102	75	101
OTHER	59	47	41	46	75	86	52	66
OPTOELECTRONIC	37	33	37	71	121	144	152	181
LED LAMPS		5	5	9	13	13	15	22
LED DISPLAYS		11	18	46	83	98	98	107
COUPLERS		1	2	5	11	15	14	20
OTHER		16	12	11	14	18	25	32

Source: DATAQUEST, Inc.

Appendix A—Market Estimate Worksheets

Table A-1
ESTIMATED WORLDWIDE SEMICONDUCTOR CONSUMPTION
(Dollars in Millions)

	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
TOTAL SEMICONDUCTOR	4614	5369	4364	5807	6526	7571	8455	9663	11153	12709
TOTAL I C	1986	2495	2116	2950	3536	4415	5100	6041	7212	8437
BIPOLAR DIGITAL	908	975	681	907	1047	1276	1438	1693	2009	2295
TTL	648	719	499	713	840	1008	1091	1266	1486	1672
DTL	118	101	81	71	55	53	43	33	25	19
ECL	65	73	55	76	94	128	158	194	246	297
OTHER	77	82	46	47	58	87	146	200	254	307
MOS	562	873	835	1242	1516	1976	2332	2827	3458	4147
PMOS	494	690	607	656	550	519	435	378	316	206
NMOS	13	72	133	382	692	1102	1479	1900	2461	3088
CMOS	55	111	95	204	274	351	418	549	681	853
LINEAR	516	647	600	801	973	1163	1330	1521	1745	1995
INTERFACE	72	91	75	89	75	81	87	89	93	99
CONTROL	200	251	248	320	390	467	547	644	747	859
ENTERTAINMENT	152	182	165	249	336	405	477	564	654	764
OTHER	92	123	117	143	172	207	219	224	251	273
HYBRID										
TOTAL DISCRETE	2465	2679	2023	2570	2702	2825	2987	3207	3460	3730
TRANSISTOR		1388	1060	1326	1365	1387	1451	1540	1641	1739
SMALL SIGNAL		866	636	797	771	744	754	777	811	840
POWER		522	424	529	594	643	697	763	830	899
DIODE		937	707	891	940	1008	1068	1161	1254	1354
SMALL SIGNAL		321	210	270	281	278	285	302	312	323
POWER		478	397	500	532	595	639	700	769	846
ZENER		138	100	121	127	135	144	159	173	185
THYRISTOR		231	180	240	279	298	326	353	393	442
OTHER		123	76	113	118	132	142	153	172	195
OPTOELECTRONIC	163	195	225	287	288	331	368	415	481	542
LED LAMPS	22	23	32	54	62	69	76	81	90	100
LED DISPLAYS	102	120	128	150	137	149	158	175	201	220
COUPLERS	15	21	22	29	32	46	56	68	81	94
OTHER	24	31	43	54	57	67	78	91	109	128

Source: DATAQUEST, Inc.

Appendix A—Market Estimate Worksheets

Table A-2

ESTIMATED NORTH AMERICAN SEMICONDUCTOR CONSUMPTION
(Dollars in Millions)

	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
TOTAL SEMICONDUCTOR	1964	2266	1810	2353	2712	3262	3670	4156	4779	5391
TOTAL I C	989	1260	1018	1418	1787	2238	2582	2998	3525	4051
BIPOLAR DIGITAL	510	573	362	488	584	705	779	898	1029	1158
TTL										
DTL										
ECL										
OTHER										
MOS	278	442	432	660	848	1115	1307	1530	1845	2168
PMOS										
NMOS										
CMOS										
LINEAR	201	245	224	270	355	418	496	570	651	725
INTERFACE										
CONTROL										
ENTERTAINMENT										
OTHER										
HYBRID										
TOTAL DISCRETE	872	884	664	791	820	897	943	996	1064	1133
TRANSISTOR		431	339	400	402	430	450	474	504	528
SMALL SIGNAL		241	179	208	198	207	210	216	227	232
POWER		190	160	192	204	223	240	258	277	296
DIODE		297	223	267	282	310	324	343	366	388
SMALL SIGNAL		95	52	65	66	69	72	74	75	78
POWER		149	128	153	156	178	187	200	218	235
ZENER		53	43	49	60	63	65	69	73	75
THYRISTOR		81	60	83	100	115	125	132	143	160
OTHER		75	42	41	36	42	44	47	51	57
OPTOELECTRONIC	103	122	128	144	105	127	145	162	190	207
LED LAMPS	11	12	13	15	15	19	22	24	28	32
LED DISPLAYS	72	84	86	90	51	58	62	71	82	89
COUPLERS	10	13	13	17	17	22	26	30	36	37
OTHER	10	13	16	22	22	28	35	37	44	49

Source: DATAQUEST, Inc.

Appendix A—Market Estimate Worksheets

Table A-3
ESTIMATED JAPANESE SEMICONDUCTOR CONSUMPTION
(Dollars in Millions)

	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
TOTAL SEMICONDUCTOR	1156	1276	996	1531	1623	1708	1885	2146	2440	2784
TOTAL I C	432	535	447	705	775	961	1092	1299	1540	1810
BIPOLAR DIGITAL	100	131	100	154	168	191	220	263	329	399
TTL										
DTL										
ECL										
OTHER										
MOS	177	241	201	283	289	399	456	576	710	856
PMOS										
NMOS										
CMOS										
LINEAR	155	163	146	268	318	371	416	460	501	555
INTERFACE										
CONTROL										
ENTERTAINMENT										
OTHER										
HYBRID										
TOTAL DISCRETE	698	710	514	776	778	682	722	764	808	868
TRANSISTOR		412	308	436	423	347	366	384	401	419
SMALL SIGNAL		293	187	290	268	205	212	220	225	233
POWER		119	121	146	155	142	154	164	176	186
DIODE		241	166	263	248	237	253	270	284	310
SMALL SIGNAL		94	70	85	74	64	64	67	69	71
POWER		121	78	154	152	152	165	175	185	207
ZENER		26	18	24	22	21	24	28	30	32
THYRISTOR		38	29	50	65	56	60	65	75	87
OTHER		19	11	29	42	42	43	45	48	52
OPTOELECTRONIC	26	31	35	48	70	65	71	83	92	106
LED LAMPS	4	4	5	9	7	8	10	10	10	12
LED DISPLAYS	13	15	16	26	37	34	35	38	41	44
COUPLERS	2	3	3	4	6	5	7	8	9	12
OTHER	7	9	11	9	20	18	19	27	32	38

Source: DATAQUEST, Inc.

Appendix A—Market Estimate Worksheets

Table A-4
ESTIMATED EUROPEAN SEMICONDUCTOR CONSUMPTION
(Dollars in Millions)

	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
TOTAL SEMICONDUCTOR	1336	1591	1333	1592	1773	2078	2254	2550	2906	3279
TOTAL I C	514	618	561	673	770	961	1086	1288	1532	1792
BIPOLAR DIGITAL	263	229	189	226	254	324	371	445	540	610
TTL										
DTL										
ECL										
OTHER										
MOS	101	168	158	216	269	336	389	478	575	710
PMOS										
NMOS										
CMOS										
LINEAR	150	221	214	231	247	301	326	365	417	472
INTERFACE										
CONTROL										
ENTERTAINMENT										
OTHER										
HYBRID										
TOTAL DISCRETE	795	944	728	852	913	1012	1052	1135	1225	1316
TRANSISTOR	0	463	351	410	442	485	498	524	560	602
SMALL SIGNAL	0	289	243	258	262	280	282	288	304	320
POWER	0	174	108	152	180	205	216	236	256	282
DIODE	0	362	282	309	344	387	403	446	484	515
SMALL SIGNAL	0	112	72	107	123	130	130	138	142	144
POWER	0	194	173	163	187	219	233	264	294	320
ZENER	0	56	37	39	34	38	40	44	48	51
THYRISTOR	0	100	82	99	99	109	117	127	140	153
OTHER	0	19	13	34	28	31	34	38	41	46
OPTOELECTRONIC	27	29	44	67	90	105	116	127	149	171
LED LAMPS	7	6	10	23	32	34	36	38	42	45
LED DISPLAYS	11	13	17	22	40	47	50	53	62	69
COUPLERS	3	4	5	5	7	9	14	19	24	29
OTHER	6	6	12	17	11	15	16	17	21	28

Source: DATAQUEST, Inc.

Appendix A—Market Estimate Worksheets

Table A-5
ESTIMATED REST OF WORLD SEMICONDUCTOR CONSUMPTION
(Dollars in Millions)

	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
TOTAL SEMICONDUCTOR	158	236	225	331	418	523	646	811	1028	1255
TOTAL I C	51	82	90	154	204	255	340	456	615	784
BIPOLAR DIGITAL	35	42	30	39	41	56	68	87	111	128
TTL										
DTL										
ECL										
OTHER										
MOS	6	22	44	83	110	126	180	243	328	413
PMOS										
NMOS										
CMOS										
LINEAR	10	18	16	32	53	73	92	126	176	243
INTERFACE										
CONTROL										
ENTERTAINMENT										
OTHER										
HYBRID										
TOTAL DISCRETE	100	141	117	149	191	234	270	312	363	413
TRANSISTOR		82	62	80	98	125	137	158	176	190
SMALL SIGNAL		43	27	41	43	52	50	53	55	55
POWER		39	35	39	55	73	87	105	121	135
DIODE		37	36	52	66	74	88	102	120	141
SMALL SIGNAL		20	16	13	18	15	19	23	26	30
POWER		14	18	30	37	46	54	61	72	84
ZENER		3	2	9	11	13	15	18	22	27
THYRISTOR		12	9	8	15	18	24	29	35	42
OTHER		10	10	9	12	17	21	23	32	40
OPTOELECTRONIC	7	13	18	28	23	34	36	43	50	58
LED LAMPS	0	1	4	7	8	8	8	9	10	11
LED DISPLAYS	6	8	9	12	9	10	11	13	16	18
COUPLERS	0	1	1	3	2	10	9	11	12	16
OTHER	1	3	4	6	4	6	8	10	12	13

Source: DATAQUEST, Inc.

Appendix A—Market Estimate Worksheets

Table A-6

ESTIMATED WORLDWIDE SEMICONDUCTOR ~~FACTORY SHIPMENTS~~ Consumption

(Dollars in Millions)

	1969	1970	1971	1972	1973	1974	1975	1976	1977
TOTAL SEMICONDUCTOR	2476	2626	2540	3148	4614	5369	4364	5807	6526
TOTAL I C	668	827	913	1245	1986	2495	2116	2950	3536
BIPOLAR DIGITAL	402	423	455	538	908	975	681	907	1047
TTL	175	175	233	349	648	719	499	713	840
DTL	141	149	116	98	118	101	81	71	55
ECL	28	53	62	58	65	73	55	76	94
OTHER	58	46	44	33	77	82	46	47	58
MOS	30	100	162	276	562	873	835	1242	1516
PMOS	29	97	153	260	494	690	607	656	550
NMOS	0	0	2	4	13	72	133	382	692
CMOS	1	3	7	12	55	111	95	204	274
LINEAR	236	304	296	431	516	647	600	801	973
INTERFACE				47	72	91	75	89	75
CONTROL				190	200	251	243	320	390
ENTERTAINMENT				100	152	182	165	249	336
OTHER				94	92	123	117	143	172
HYBRID				0	0	0	0	0	0
TOTAL DISCRETE	1764	1749	1574	1796	2465	2679	2023	2570	2702
TRANSISTOR	869	878	828	938	1307	1388	1060	1326	1365
SMALL SIGNAL	585	574	518	597	812	866	636	797	771
POWER	284	304	310	341	495	522	424	529	594
DIODE	692	665	558	642	846	937	707	891	940
SMALL SIGNAL	287	255	176	206	277	321	210	270	281
POWER	305	316	309	347	456	478	397	500	532
ZENER	100	94	73	89	113	138	100	121	127
THYRISTOR	119	123	110	123	195	231	180	240	279
OTHER	84	83	78	93	117	123	76	113	118
OPTOELECTRONIC	44	50	53	107	163	195	225	287	288
LED LAMPS	0	6	6	15	22	23	32	54	62
LED DISPLAYS	0	13	21	55	102	120	128	150	137
COUPLERS	0	1	2	7	15	21	22	29	32
OTHER	44	30	24	30	24	31	43	54	57

Source: DATAQUEST, Inc.

Appendix A—Market Estimate Worksheets

Table A-7

ESTIMATED NORTH AMERICAN SEMICONDUCTOR FACTORY SHIPMENTS
(Dollars in Millions)

	1969	1970	1971	1972	1973	1974	1975	1976	1977
TOTAL SEMICONDUCTOR	1327	1210	1161	1498	2209	2622	2119	2683	3118
TOTAL I C	498	524	537	749	1192	1495	1216	1631	2035
BIPOLAR DIGITAL	326	287	263	342	556	594	395	508	623
TTL	142	116	135	224	428	469	303	413	537
DTL	114	100	69	63	61	49	43	41	34
ECL	23	34	38	36	41	45	33	39	40
OTHER	47	37	21	19	26	31	16	15	12
MOS	21	75	101	169	383	592	538	807	994
PMOS	20	72	93	156	323	432	353	337	242
NMOS	0	0	2	4	12	66	108	307	530
CMOS	1	3	6	9	48	94	77	163	222
LINEAR	151	162	173	238	253	309	283	316	418
INTERFACE									
CONTROL									
ENTERTAINMENT									
OTHER									
HYBRID									
TOTAL DISCRETE	792	653	587	678	896	983	751	889	948
TRANSISTOR	363	290	303	358	440	468	368	418	453
SMALL SIGNAL	233	175	178	208	230	254	189	225	235
POWER	130	115	125	150	210	214	179	193	218
DIODE	307	256	189	210	286	327	256	300	319
SMALL SIGNAL	143	104	51	47	73	95	62	73	79
POWER	108	101	102	119	159	169	142	164	174
ZENER	56	51	36	44	54	63	52	63	66
THYRISTOR	63	60	54	64	95	102	75	104	118
OTHER	59	47	41	46	75	86	52	67	58
OPTOELECTRONIC	37	33	37	71	121	144	152	163	135
LED LAMPS	0	5	5	9	13	13	15	19	23
LED DISPLAYS	0	11	18	46	83	98	98	98	69
COUPLERS	0	1	2	5	11	15	14	20	21
OTHER	37	16	12	11	14	18	25	26	22

Source: DATAQUEST, Inc.

Appendix A—Market Estimate Worksheets

Table A-8

ESTIMATED JAPANESE SEMICONDUCTOR FACTORY SHIPMENTS

(Dollars in Millions)

	1969	1970	1971	1972	1973	1974	1975	1976	1977
TOTAL SEMICONDUCTOR	506	763	664	832	1138	1167	916	1504	1619
TOTAL I C	87	167	168	241	372	418	392	658	713
BIPOLAR DIGITAL	35	70	63	50	82	105	75	105	124
TTL									
DTL									
ECL									
OTHER									
MOS	8	20	50	82	140	156	184	287	295
PMOS	8	20	49	80	135	142	152	198	160
NMOS	0	0	0	0	1	4	19	59	105
CMOS	0	0	1	2	4	10	13	30	30
LINEAR	44	77	55	109	150	157	133	266	294
INTERFACE									
CONTROL									
ENTERTAINMENT									
OTHER									
HYBRID									
TOTAL DISCRETE	419	585	486	568	748	733	502	808	845
TRANSISTOR	244	339	277	315	430	427	302	468	461
SMALL SIGNAL	162	225	172	215	311	302	187	298	280
POWER	82	114	105	100	119	125	115	170	181
DIODE	139	201	173	205	255	241	162	274	283
SMALL SIGNAL	53	76	54	69	88	86	57	87	85
POWER	76	110	107	121	147	130	87	160	171
ZENER	10	15	12	15	20	25	18	27	27
THYRISTOR	23	34	26	25	43	45	27	45	62
OTHER	13	11	10	23	20	20	11	21	39
OPTOELECTRONIC	0	11	10	23	18	16	22	38	61
LED LAMPS	0	0	0	2	3	2	3	6	5
LED DISPLAYS	0	1	2	7	10	8	10	21	29
COUPLERS	0	0	0	1	2	2	3	3	3
OTHER	0	10	8	13	3	4	6	8	24

Source: DATAQUEST, Inc.

Appendix A—Market Estimate Worksheets

Table A-9

ESTIMATED EUROPEAN SEMICONDUCTOR FACTORY SHIPMENTS
(Dollars in Millions)

	1969	1970	1971	1972	1973	1974	1975	1976	1977
TOTAL SEMICONDUCTOR	633	641	698	789	1195	1448	1209	1422	1598
TOTAL I C	83	136	206	250	403	531	457	556	684
BIPOLAR DIGITAL	41	66	127	141	252	246	181	227	241
TTL									
DTL									
ECL									
OTHER									
MOS	1	5	11	25	39	122	108	142	220
PMOS	1	5	11	24	36	113	97	115	141
NMOS	0	0	0	0	0	2	6	16	57
CMOS	0	0	0	1	3	7	5	11	22
LINEAR	41	65	68	84	112	163	168	187	223
INTERFACE									
CONTROL									
ENTERTAINMENT									
OTHER									
HYBRID									
TOTAL DISCRETE	543	499	486	527	771	893	717	805	836
TRANSISTOR	256	241	238	250	396	443	350	384	392
SMALL SIGNAL	184	166	158	159	230	260	220	223	203
POWER	72	75	80	91	166	183	130	161	189
DIODE	242	204	191	219	296	349	276	305	324
SMALL SIGNAL	87	71	66	82	107	120	78	98	103
POWER	121	105	100	107	150	179	168	176	187
ZENER	34	28	25	30	39	50	30	31	34
THYRISTOR	33	29	30	34	57	84	78	91	99
OTHER	12	25	27	24	22	17	13	25	21
OPTOELECTRONIC	7	6	6	12	21	24	35	61	78
LED LAMPS	0	1	1	4	6	6	10	23	31
LED DISPLAYS	0	1	1	2	7	9	13	20	34
COUPLERS	0	0	0	1	2	3	3	4	6
OTHER	7	4	4	5	6	6	9	14	7

Source: DATAQUEST, Inc.

Table A-10

ESTIMATED REST OF WORLD SEMICONDUCTOR FACTORY SHIPMENTS

(Dollars in Millions)

	1969	1970	1971	1972	1973	1974	1975	1976	1977
TOTAL SEMICONDUCTOR	10	12	17	29	72	132	120	198	191
TOTAL I C	0	0	2	5	19	51	51	105	104
BIPOLAR DIGITAL	0	0	2	5	18	30	30	67	59
TTL									
DTL									
ECL									
OTHER									
MOS	0	0	0	0	0	3	5	6	7
PMOS	0	0	0	0	0	3	5	6	7
NMOS	0	0	0	0	0	0	0	0	0
CMOS	0	0	0	0	0	0	0	0	0
LINEAR	0	0	0	0	1	18	16	32	38
INTERFACE									
CONTROL									
ENTERTAINMENT									
OTHER									
HYBRID									
TOTAL DISCRETE	10	12	15	23	50	70	53	68	73
TRANSISTOR	6	8	10	15	41	50	40	56	59
SMALL SIGNAL	6	8	10	15	41	50	40	51	53
POWER	0	0	0	0	0	0	0	5	6
DIODE	4	4	5	8	9	20	13	12	14
SMALL SIGNAL	4	4	5	8	9	20	13	12	14
POWER	0	0	0	0	0	0	0	0	0
ZENER	0	0	0	0	0	0	0	0	0
THYRISTOR	0	0	0	0	0	0	0	0	0
OTHER	0	0	0	0	0	0	0	0	0
OPTOELECTRONIC	0	0	0	1	3	11	16	25	14
LED LAMPS	0	0	0	0	0	2	4	6	3
LED DISPLAYS	0	0	0	0	2	5	7	11	5
COUPLERS	0	0	0	0	0	1	2	2	2
OTHER	0	0	0	1	1	3	3	6	4

Source: DATAQUEST, Inc.

Table A-11
ESTIMATED WORLDWIDE SEMICONDUCTOR CONSUMPTION
(Units in Millions)

	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
TOTAL SEMICONDUCTOR	6881	7385	8287	11253	16266	18855	14913	19210	21355	24054	25758	28117	30915	33209
TOTAL I C	383	541	751	1199	1972	2422	2116	2954	3427	4484	5247	6098	7022	7909
BIPOLAR DIGITAL	268.5	353.9	521.6	749.3	1328	1517	1146	1494	1635	2127	2479	2919	3348	3702
TTL	91.1	127.7	294.9	491.5	982	1219	902	1261	1400					
DTL	118.5	167.4	165.7	200.8	246	171	150	109	71					
ECL	9.7	20.1	23.4	23.8	35	60	55	83	104					
OTHER	49.2	38.7	37.6	34.0	65	67	39	41	60					
MOS	3.4	13.9	21.8	45.6	110	217	304	515	668	959	1166	1346	1572	1803
PMOS	3.3	13.6	20.6	41.9	84	128	152	155	130					
NMOS	0.0	0.0	0.2	0.7	4	15	30	80	141					
CMOS	0.1	0.3	1.0	3.0	22	74	122	280	397					
LINEAR	111.3	172.7	208.5	404.0	534	688	666	945	1124	1398	1602	1833	2102	2464
INTERFACE				30.3	50	67	61	82	66					
CONTROL				154.5	187	246	253	354	429					
ENTERTAINMENT				112.4	203	249	228	349	492					
OTHER				106.8	94	126	124	160	187					
HYBRID														
TOTAL DISCRETE	6498	6830	7514	9973	14160	16242	12536	15825	17340	18818	19591	20897	22519	23706
TRANSISTOR	2318	2321	2465	3364	5115	5740	4796	6731	7217	8159	8461	8755	9117	9153
SMALL SIGNAL	2089	2050	2158	2985	4511	5029	4173	5992	6425					
POWER	229	271	307	379	604	711	623	739	792					
DIODE	4083	4407	4917	6419	8736	10136	7448	8694	9620	10080	10480	11410	12540	13540
SMALL SIGNAL	2870	3188	3520	4120	5540	6440	4220	4317	4683					
POWER	1017	1019	1188	1928	2682	3006	2640	3564	4090					
ZENER	196	200	209	371	514	690	588	813	847					
THYRISTOR	77	92	94	128	222	269	217	272	321	339	366	392	432	486
OTHER DISCRETE	10	10	38	62	87	97	75	128	182	240	284	340	430	527
OPTOELECTRONIC	10	14	22	82	134	191	261	431	588	752	920	1122	1374	1594

Source: DATAQUEST, Inc.

Appendix A—Market Estimate Worksheets

Table A-1

ESTIMATED WORLDWIDE SEMICONDUCTOR CONSUMPTION
(Dollars in Millions)

	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
TOTAL SEMICONDUCTOR	4616	5373	4348	5762	6310	7283	8123	9590	11000	12628
TOTAL I C	1986	2495	2097	2936	3443	4063	4572	5510	6387	7401
BIPOLAR DIGITAL	908	975	672	903	1038	1204	1312	1509	1690	1902
TTL	648	719	496	719	833	952	995	1128	1250	1386
DTL	118	101	81	71	58	50	40	30	20	10
ECL	65	73	55	76	94	120	144	173	207	249
OTHER	77	82	40	37	53	82	133	178	213	257
MOS	562	873	835	1228	1430	1742	2020	2520	3009	3583
PMOS	494	690	607	649	526	502	452	398	358	322
NMOS	13	72	133	377	634	902	1176	1636	2068	2561
CMOS	55	111	95	202	270	338	392	486	583	700
LINEAR	516	647	590	805	975	1117	1240	1481	1688	1916
INTERFACE	72	91	74	89	75	78	81	85	90	95
CONTROL	200	251	240	322	390	450	510	629	722	825
ENTERTAINMENT	152	182	162	251	338	390	445	549	634	734
OTHER	92	123	114	143	172	199	204	218	242	262
HYBRID										
TOTAL DISCRETE	2465	2681	2034	2546	2627	2941	3229	3679	4134	4655
TRANSISTOR	1307	1388	1068	1318	1330	1456	1573	1763	1946	2139
SMALL SIGNAL	812	855	626	779	745	776	810	856	905	943
POWER	495	533	442	539	585	680	763	907	1041	1196
DIODE	846	941	707	888	904	1013	1114	1269	1415	1581
SMALL SIGNAL	277	322	211	259	236	248	275	314	352	393
POWER	456	481	396	499	520	598	655	745	829	932
ZENER	113	138	100	130	148	167	184	210	234	256
THYRISTOR	195	231	180	231	280	335	398	476	570	693
OTHER	117	121	79	109	113	137	144	171	203	242
OPTOELECTRONIC	165	197	217	280	240	279	322	401	479	572
LED LAMPS	22	23	29	40	40	45	49	61	72	89
LED DISPLAYS	102	120	125	141	90	95	106	128	149	175
COUPLERS	15	21	22	30	40	55	70	90	115	136
OTHER	26	33	41	69	70	84	97	122	143	172

Source: DATAQUEST, Inc.

Appendix A—Market Estimate Worksheets

Table A-2

ESTIMATED NORTH AMERICAN SEMICONDUCTOR CONSUMPTION
(Dollars in Millions)

	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
TOTAL SEMICONDUCTOR	1964	2270	1818	2362	2659	3100	3384	3934	4383	4867
TOTAL I C	989	1260	1018	1414	1746	2041	2246	2646	2991	3364
BIPOLAR DIGITAL	510	573	362	488	584	668	713	803	880	968
TTL										
DTL										
ECL										
OTHER										
MOS	278	442	432	650	805	973	1099	1334	1548	1781
PMOS										
NMOS										
CMOS										
LINEAR	201	245	224	276	357	400	434	509	563	615
INTERFACE										
CONTROL										
ENTERTAINMENT										
OTHER										
HYBRID										
TOTAL DISCRETE	872	888	672	797	812	937	999	1121	1196	1279
TRANSISTOR		431	347	407	404	455	473	522	545	566
SMALL SIGNAL		230	169	197	192	204	210	226	239	245
POWER		201	178	210	212	251	263	296	306	321
DIODE		301	223	270	272	314	332	373	395	415
SMALL SIGNAL		96	53	60	50	54	58	65	69	72
POWER		152	127	156	152	182	190	215	227	239
ZENER		53	43	54	70	78	84	93	99	104
THYRISTOR		81	60	80	100	123	148	173	198	234
OTHER		75	42	40	36	45	46	53	58	64
OPTOELECTRONIC	103	122	128	151	101	122	139	167	196	224
LED LAMPS	11	12	13	18	16	19	21	25	28	32
LED DISPLAYS	72	84	86	94	42	46	52	63	72	83
COUPLERS	10	13	13	17	21	27	33	41	52	58
OTHER	10	13	16	22	22	30	33	38	44	51

Source: DATAQUEST, Inc.

Appendix A—Market Estimate Worksheets

Table A-3

ESTIMATED JAPANESE SEMICONDUCTOR CONSUMPTION
(Dollars in Millions)

	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
TOTAL SEMICONDUCTOR	1158	1276	1001	1547	1616	1847	2073	2473	2870	3337
TOTAL I C	432	535	447	709	767	909	1038	1269	1492	1754
BIPOLAR DIGITAL	100	131	100	154	168	200	224	264	304	349
TTL										
DTL										
ECL										
OTHER										
MOS	177	241	201	283	281	343	408	522	637	777
PMOS										
NMOS										
CMOS										
LINEAR	155	163	146	272	318	366	406	483	551	628
INTERFACE										
CONTROL										
ENTERTAINMENT										
OTHER										
HYBRID										
TOTAL DISCRETE	698	708	517	779	779	861	946	1087	1242	1417
TRANSISTOR		412	308	436	423	459	499	563	633	710
SMALL SIGNAL		293	187	290	268	284	293	306	320	333
POWER		119	121	146	155	175	206	257	313	377
DIODE		241	166	263	248	275	304	351	402	456
SMALL SIGNAL		94	70	85	74	77	85	98	113	126
POWER		121	78	154	152	171	187	216	246	282
ZENER		26	18	24	22	27	32	37	43	48
THYRISTOR		38	29	50	66	78	90	110	132	160
OTHER		17	14	30	42	49	53	63	75	91
OPTOELECTRONIC	28	33	37	59	70	77	89	117	136	166
LED LAMPS	4	4	5	6	8	10	12	16	19	26
LED DISPLAYS	13	15	16	18	22	22	25	30	35	42
COUPLERS	2	3	3	4	7	12	16	22	27	32
OTHER	9	11	13	31	33	33	36	49	55	66

Source: DATAQUEST, Inc.

Appendix A—Market Estimate Worksheets

Table A-4

ESTIMATED EUROPEAN SEMICONDUCTOR CONSUMPTION
(Dollars in Millions)

	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
TOTAL SEMICONDUCTOR	1336	1591	1304	1521	1639	1862	2078	2412	2767	3174
TOTAL I C	514	618	542	659	741	880	994	1203	1398	1626
BIPOLAR DIGITAL	263	229	180	222	245	287	315	366	413	467
TTL										
DTL										
ECL										
OTHER										
MOS	101	168	158	212	249	306	358	452	542	650
PMOS										
NMOS										
CMOS										
LINEAR	150	221	204	225	247	287	321	385	443	509
INTERFACE										
CONTROL										
ENTERTAINMENT										
OTHER										
HYBRID										
TOTAL DISCRETE	795	944	728	821	849	925	1019	1130	1272	1430
TRANSISTOR		463	351	395	405	430	466	507	560	613
SMALL SIGNAL		289	243	251	242	242	253	264	278	288
POWER		174	108	144	163	188	213	243	282	325
DIODE		362	282	303	322	351	388	430	481	536
SMALL SIGNAL		112	72	101	98	102	113	124	139	155
POWER		194	173	159	179	201	224	248	278	312
ZENER		56	37	43	45	48	51	58	64	69
THYRISTOR		100	82	93	99	116	137	161	194	237
OTHER		19	13	30	23	28	28	32	37	44
OPTOELECTRONIC	27	29	34	41	49	57	65	79	97	118
LED LAMPS	7	6	7	9	10	12	12	14	17	20
LED DISPLAYS	11	13	14	17	20	20	21	25	29	34
COUPLERS	3	4	5	5	8	10	13	17	23	29
OTHER	6	6	8	10	11	15	19	23	28	35

Source: DATAQUEST, Inc.

Appendix A—Market Estimate Worksheets

Table A-5

ESTIMATED REST OF WORLD SEMICONDUCTOR CONSUMPTION
(Dollars in Millions)

	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
TOTAL SEMICONDUCTOR	158	236	225	332	396	474	588	771	980	1250
TOTAL I C	51	82	90	154	189	233	294	392	506	657
BIPOLAR DIGITAL	35	42	30	39	41	49	60	76	93	119
TTL										
DTL										
ECL										
OTHER										
MOS	6	22	44	83	95	120	155	212	282	375
PMOS										
NMOS										
CMOS										
LINEAR	10	18	16	32	53	64	79	104	131	164
INTERFACE										
CONTROL										
ENTERTAINMENT										
OTHER										
HYBRID										
TOTAL DISCRETE	100	141	117	149	187	218	265	341	424	529
TRANSISTOR		82	62	80	98	112	135	171	208	250
SMALL SIGNAL		43	27	41	43	46	54	60	68	77
POWER		39	35	39	55	66	81	111	140	173
DIODE		37	36	52	62	73	90	115	137	174
SMALL SIGNAL		20	16	13	14	15	19	27	31	40
POWER		14	18	30	37	44	54	66	78	99
ZENER		3	2	9	11	14	17	22	28	35
THYRISTOR		12	9	8	15	18	23	32	46	62
OTHER		10	10	9	12	15	17	23	33	43
OPTOELECTRONIC	7	13	18	29	20	23	29	38	50	64
LED LAMPS	0	1	4	7	6	4	4	6	8	11
LED DISPLAYS	6	8	9	12	6	7	8	10	13	16
COUPLERS	0	1	1	4	4	6	8	10	13	17
OTHER	1	3	4	6	4	6	9	12	16	20

Source: DATAQUEST, Inc.

Appendix A—Market Estimate Worksheets

Table A-6 = A1

ESTIMATED WORLDWIDE SEMICONDUCTOR CONSUMPTION FACTORY SHIPMENTS

(Dollars in Millions)

	1969	1970	1971	1972	1973	1974	1975	1976	1977
TOTAL SEMICONDUCTOR	2476	2626	2540	3148	4616	5373	4348	5762	6310
TOTAL I C	668	827	913	1245	1986	2495	2097	2936	3443
BIPOLAR DIGITAL	402	423	455	538	908	975	672	903	1038
TTL	175	175	233	349	648	719	496	719	833
DTL	141	149	116	98	118	101	81	71	58
ECL	28	53	62	58	65	73	55	76	94
OTHER	58	46	44	33	77	82	40	37	53
MOS	30	100	162	276	562	873	835	1228	1430
PMOS	29	97	153	260	494	690	607	649	526
NMOS	0	0	2	4	13	72	133	377	634
CMOS	1	3	7	12	55	111	95	202	270
LINEAR	236	304	296	431	516	647	590	805	975
INTERFACE				47	72	91	74	89	75
CONTROL				190	200	251	240	322	390
ENTERTAINMENT				100	152	182	162	251	338
OTHER				94	92	123	114	143	172
HYBRID									
TOTAL DISCRETE	1764	1749	1574	1796	2465	2681	2034	2546	2627
TRANSISTOR	869	878	828	938	1307	1388	1068	1318	1330
SMALL SIGNAL	585	574	518	597	812	855	626	779	745
POWER	284	304	310	341	495	533	442	539	585
DIODE	692	665	558	642	846	941	707	888	904
SMALL SIGNAL	287	255	176	206	277	322	211	259	236
POWER	305	316	309	347	456	481	396	499	520
ZENER	100	94	73	89	113	138	100	130	148
THYRISTOR	119	123	110	123	195	231	180	231	280
OTHER	84	83	78	93	117	121	79	109	113
OPTOELECTRONIC	44	50	53	107	165	197	217	280	240
LED LAMPS		6	6	15	22	23	29	40	40
LED DISPLAYS		13	21	55	102	120	125	141	90
COUPLERS		1	2	7	15	21	22	30	40
OTHER		30	24	30	26	33	41	69	70

Source: DATAQUEST, Inc.

Appendix A—Market Estimate Worksheets

Table A-7

ESTIMATED NORTH AMERICAN SEMICONDUCTOR FACTORY SHIPMENTS
(Dollars in Millions)

	1969	1970	1971	1972	1973	1974	1975	1976	1977
TOTAL SEMICONDUCTOR	1327	1210	1161	1498	2209	2626	2132	2703	3020
TOTAL I C	498	524	537	749	1192	1495	1221	1637	1968
BIPOLAR DIGITAL	326	287	263	342	556	594	400	519	618
TTL	142	116	135	224	428	469	308	429	538
DTL	114	100	69	63	61	49	43	41	36
ECL	23	34	38	36	41	45	33	39	35
OTHER	47	37	21	19	26	31	16	10	9
MOS	21	75	101	169	383	592	538	798	930
PMOS	20	72	93	156	323	432	353	332	226
NMOS	0	0	2	4	12	66	108	304	484
CMOS	1	3	6	9	48	94	77	162	220
LINEAR	151	162	173	238	253	309	283	320	420
INTERFACE									
CONTROL									
ENTERTAINMENT									
OTHER									
HYBRID									
TOTAL DISCRETE	792	653	587	678	896	987	759	895	928
TRANSISTOR	363	290	303	358	440	468	376	425	451
SMALL SIGNAL	233	175	178	208	230	243	179	214	223
POWER	130	115	125	150	210	225	197	211	228
DIODE	307	256	189	210	286	331	256	303	300
SMALL SIGNAL	143	104	51	47	73	96	63	68	54
POWER	108	101	102	119	159	172	141	167	170
ZENER	56	51	36	44	54	63	52	68	76
THYRISTOR	63	60	54	64	95	102	75	101	119
OTHER	59	47	41	46	75	86	52	66	58
OPTOELECTRONIC	37	33	37	71	121	144	152	171	124
LED LAMPS		5	5	9	13	13	15	22	23
LED DISPLAYS		11	18	46	83	98	98	102	57
COUPLERS		1	2	5	11	15	14	20	22
OTHER		16	12	11	14	18	25	27	22

Source: DATAQUEST, Inc.

Appendix A—Market Estimate Worksheets

Table A-8

ESTIMATED JAPANESE SEMICONDUCTOR FACTORY SHIPMENTS
(Dollars in Millions)

	1969	1970	1971	1972	1973	1974	1975	1976	1977
TOTAL SEMICONDUCTOR	506	763	664	832	1140	1167	921	1514	1614
TOTAL I C	87	167	168	241	372	418	392	657	708
BIPOLAR DIGITAL	35	70	63	50	82	105	75	105	124
TTL									
DTL									
ECL									
OTHER									
MOS	8	20	50	82	140	156	184	286	290
PMOS	8	20	49	80	135	142	152	198	160
NMOS	0	0	0	0	1	4	19	58	100
CMOS	0	0	1	2	4	10	13	30	30
LINEAR	44	77	55	109	150	157	133	266	294
INTERFACE									
CONTROL									
ENTERTAINMENT									
OTHER									
HYBRID									
TOTAL DISCRETE	419	585	486	568	748	731	505	809	845
TRANSISTOR	244	339	277	315	430	427	302	468	461
SMALL SIGNAL	162	225	172	215	311	302	187	298	280
POWER	82	114	105	100	119	125	115	170	181
DIODE	139	201	173	205	255	241	162	274	283
SMALL SIGNAL	53	76	54	69	88	86	57	87	85
POWER	76	110	107	121	147	130	87	160	171
ZENER	10	15	12	15	20	25	18	27	27
THYRISTOR	23	34	26	25	43	45	27	45	62
OTHER	13	11	10	23	20	18	14	22	39
OPTOELECTRONIC		11	10	23	20	18	24	48	61
LED LAMPS		0	0	2	3	2	3	3	5
LED DISPLAYS		1	2	7	10	8	10	13	14
COUPLERS		0	0	1	2	2	3	3	5
OTHER		10	8	13	5	6	8	29	37

Source: DATAQUEST, Inc.

Table A-9

ESTIMATED EUROPEAN SEMICONDUCTOR FACTORY SHIPMENTS
(Dollars in Millions)

	1969	1970	1971	1972	1973	1974	1975	1976	1977
TOTAL SEMICONDUCTOR	633	641	698	789	1195	1448	1175	1345	1483
TOTAL I C	83	136	206	250	403	531	433	537	663
BIPOLAR DIGITAL	41	66	127	141	252	246	167	212	237
TTL									
DTL									
ECL									
OTHER									
MOS	1	5	11	25	39	122	108	138	203
PMOS	1	5	11	24	36	113	97	113	133
NMOS	0	0	0	0	0	2	6	15	50
CMOS	0	0	0	1	3	7	5	10	20
LINEAR	41	65	68	84	112	163	158	187	223
INTERFACE									
CONTROL									
ENTERTAINMENT									
OTHER									
HYBRID									
TOTAL DISCRETE	543	499	486	527	771	893	717	774	781
TRANSISTOR	256	241	238	250	396	443	350	369	359
SMALL SIGNAL	184	166	158	159	230	260	220	216	189
POWER	72	75	80	91	166	183	130	153	170
DIODE	242	204	191	219	296	349	276	299	307
SMALL SIGNAL	87	71	66	82	107	120	78	92	83
POWER	121	105	100	107	150	179	168	172	179
ZENER	34	28	25	30	39	50	30	35	45
THYRISTOR	33	29	30	34	57	84	78	85	99
OTHER	12	25	27	24	22	17	13	21	16
OPTOELECTRONIC	7	6	6	12	21	24	25	34	39
LED LAMPS		1	1	4	6	6	7	9	9
LED DISPLAYS		1	1	2	7	9	10	15	14
COUPLERS		0	0	1	2	3	3	4	9
OTHER		4	4	5	6	6	5	6	7

Source: DATAQUEST, Inc.

Table A-10

ESTIMATED REST OF WORLD SEMICONDUCTOR FACTORY SHIPMENTS
(Dollars in Millions)

	1969	1970	1971	1972	1973	1974	1975	1976	1977
TOTAL SEMICONDUCTOR	10	12	17	29	72	132	120	200	193
TOTAL I C	0	0	2	5	19	51	51	105	104
BIPOLAR DIGITAL	0	0	2	5	18	30	30	67	59
TTL									
DTL									
ECL									
OTHER									
MOS	0	0	0	0	0	3	5	6	7
PMOS	0	0	0	0	0	3	5	6	7
NMOS	0	0	0	0	0	0	0	0	0
CMOS	0	0	0	0	0	0	0	0	0
LINEAR	0	0	0	0	1	18	16	32	38
INTERFACE									
CONTROL									
ENTERTAINMENT									
OTHER									
HYBRID									
TOTAL DISCRETE	10	12	15	23	50	70	53	68	78
TRANSISTOR	6	8	10	15	41	50	40	56	59
SMALL SIGNAL	6	8	10	15	41	50	40	51	53
POWER	0	0	0	0	0	0	0	5	6
DIODE	4	4	5	8	9	20	13	12	14
SMALL SIGNAL	4	4	5	8	9	20	13	12	14
POWER	0	0	0	0	0	0	0	0	0
ZENER	0	0	0	0	0	0	0	0	0
THYRISTOR	0	0	0	0	0	0	0	0	0
OTHER	0	0	0	0	0	0	0	0	0
OPTOELECTRONIC	0	0	0	1	3	11	16	27	16
LED LAMPS	0	0	0	0	0	2	4	6	3
LED DISPLAYS	0	0	0	0	2	5	7	11	5
COUPLERS	0	0	0	0	0	1	2	3	4
OTHER	0	0	0	1	1	3	3	7	4

Source: DATAQUEST, Inc.

Appendix A—Market Estimate Worksheets

INTRODUCTION

Appendix A consists of a set of detailed tables that estimate semiconductor consumption and semiconductor factory shipments both worldwide and for four major geographical regions. Tables A-1 details world semiconductor consumption. Table A-2 through A-5 estimate semiconductor consumption for four geographical regions—North America, Western Europe, Japan, and the Rest of the World (ROW), respectively.

Table A-6 details world factory shipments of semiconductors. Tables A-7 through A-10 estimate semiconductor production in North America, Western Europe, Japan, and the Rest of the World. The differences between Tables A-2 through A-5 and Tables A-7 through A-10, for each geographic region, represent net exports from those regions.

Each table gives estimates for semiconductor consumption or shipments by the major product categories of semiconductor devices. In these tables, semiconductor components have been divided into three major product groups: integrated circuits, discrete devices, and optoelectronic devices. Each of these groups is divided into a number of subgroups, some of which are further segmented. Totals for each device group or subgroup are presented at the top of each category. In general, these product divisions are self-explanatory. The difference between low-power and high-power transistors is set at the 1-watt power handling capability. Power diodes are rated at greater than 1 amp; signal diodes at less than 1 amp.

Special discrete devices that are neither transistors, diodes, nor thrysistors are categorized as "Other."

DEFINITIONS AND CONVENTIONS

DATAQUEST utilizes a common basis of manufacturers for all data tables. This basis includes all non-captive suppliers to the semiconductor market. It excludes captive suppliers that manufacture devices solely for the benefit of the parent company, such as Burroughs, IBM, NCR, and Western Electric. Included, however, are companies that actively market semiconductor devices to industry as well as to other divisions of their own company. For these companies, both external shipments and internal consumption are included. Devices used internally are valued at current market prices.

For purposes of Appendix A, consumption is defined as the purchase of a semiconductor device or devices. This definition must be differentiated from actual use of the device in a final product. Devices that are inventoried at the user level are considered consumption under our definition.

The fabrication and assembly of a semiconductor device may be performed in several different locations. For the purposes of this data base, factory shipments are defined geographically as occurring from that point where the device was tested and marked, irrespective of where the device was assembled or where initial wafer fabrication was performed. In general, factory shipments and production are equated, but devices inventoried at the manufacturer's level are not included in DATAQUEST's basis for factory shipments.

Because of prior reporting methods used by the Electronic Industries Association (EIA) and the Japanese Ministry for International Trade and Industry (MITI), hybrid devices are included as a product segment of integrated circuits prior to 1973. This segmentation is somewhat artificial because hybrid devices are primarily a special packaging arrangement. As a result, DATAQUEST has deleted this segment for the years after 1973, and hybrid devices manufactured by semiconductor companies are included in the most appropriate product segment.

The detailed definitions of basis we have

Appendix A--Market Estimate Worksheets

used may differ from those used in other studies of this type. Our basis is nearly the same as that used by the American Electronic Association (formerly WEMA), but is different from that used by many companies.

Certain assumptions or conventions implicit in our forecast may differ from those of others' forecasts.

DATA SOURCES

There exists no single official source of information on worldwide production and trade in semiconductors. The information presented in Appendix A has been consolidated from a wide variety of fragmentary sources, each of which focuses on a specific part of the market.

Historical U.S. data prior to 1973 rely to a large degree on data collected by the Electronics Industry Association (EIA). More recent data are compiled from a variety of published and nonpublished sources.

There is no single source of data on European semiconductor production. For European markets, U.S. Department of Commerce trade statistics, marketing statistics from the Semiconductor Industry Association (SIA), and shipment estimates for each individual company are the primary data sources used.

In Japan, many statistics are compiled and published by MITI.

U.S. Commerce Department trade statistics and MITI trade statistics constitute the major published sources used to estimate ROW consumption and factory shipments.

It should be clear from the broad scope and detailed breakdown of tables that their development is a major effort. We believe that the estimates presented here are the most accurate and meaningful generally available today. The sources of the data presented in the tables are:

- Unit sales or revenues (or both) published by major industry participants, both in the U.S. and abroad
- Estimates presented by knowledgeable and reliable industry spokesmen
- Government data or trade association data such as EIA, MITI, SIA, and the U.S. Department of Commerce
- Published product literature and price lists
- Interviews with knowledgeable manufacturers, distributors, and users
- Relevant projected world economic data

CONSISTENCY

One of the key objectives in preparing these estimates has been to achieve consistency among the various data elements that constitute the forecast and the past data base. The opportunity to check the numeric value of a directly obtained data element by deriving it indirectly from other data elements by one or more alternative means has been of great assistance in assuring the accuracy and consistency of the estimates. Thus, the data in Appendix A are consistent with the Market Share estimates in Appendix B and with the individual company revenue breakdowns presented in Chapters 8, 9, and 10, as well as with summary tables presented in Chapter 2, "Semiconductor Markets."

ACCURACY

The tables presented here represent DATAQUEST estimates that we believe are reasonably accurate. Where we have no reasonable estimate, none are given. A blank space in a table indicates the unavailability of a reasonably accurate estimate, and a zero in a table represents an estimate.

Appendix A—Market Estimate Worksheets

VALUATION OF CONSUMPTION AND FACTORY SHIPMENTS

Regional Consumption and Factory Shipments amounts are expressed in U.S. dollars. To make the tables of Appendix A useful in comparing different regions, it is necessary to express all values in a common currency and, because of U.S. producers' large presence in the international markets, the dollar was the preferred choice.

However, the choice of the U.S. dollar (or any single currency, for that matter) as the currency basis for the tables, brings with it some problems that require readers to take careful consideration in interpreting the data.

Inflation

All countries that participate significantly in international semiconductor markets have, to a greater or lesser extent, suffered from an overall price inflation in the 1970s.

As a consequence, the dollar in a given year is not truly comparable with the dollar in any preceding year. Consumer and wholesale Price Indices and GNP Deflators all measure price changes in various composite "market baskets" of goods. However, there is no price index that measures price changes of material and labor inputs to the semiconductor industry. Indeed the "mix" is changing so rapidly that what is used this year was sometimes unavailable last year, at any price. Nor is there a composite price index that measures price changes in aggregate semiconductor product. In an industry noted for its deflationary trends, this latter effect would tend to make the component purchaser's dollar worth more as time passed in terms of purchasing electronic capability.

We have made no adjustments in the historical data to account for these inflationary and deflationary effects. The data is left in current dollars for all historical data, and comparisons between different years must be interpreted accordingly.

Exchange Rates

Construction of the tables requires combining data from many countries, each of which has different and changing exchange rates. This situation raises a related issue of how to express foreign production in terms of current U.S. dollars.

Because approximately 50 percent of European consumption is produced by U.S. companies, estimates of overall European market dimensions by DATAQUEST have always been made directly in dollars. For 1978, about 9 percent growth over 1977 in European consumption reflects exchange rate effects.

However, Japanese consumption and factory shipments have been translated from MITI data, which are originally expressed in yen. Until this edition (June 1979), which includes estimates for 1978, we have translated yen to dollars at the historical ratio of 300 yen to one dollar. While this exchange rate was a reasonably good approximation through mid-1977, the annual 1977 rate was about 265 yen per dollar, while for 1978 the annual rate was 207 yen per dollar. At one point in mid-1978, the rate was 176 yen per dollar; at the time of this publication it rests at about 218 yen per dollar.

By maintaining a constant exchange rate of 300 yen per dollar, we tended to understate the Japanese market size, but remained true to the year-to-year market size growth rate. This year, we have presented our Japanese market data both at dollar amounts calculated from yen at the exchange rate applicable during the period of estimation and in terms of yen alone, in which case the effect of a fluctuating exchange rate is removed altogether. Table A-13 (Estimated Japanese Semiconductor Consumption), and Table A-14 (Estimated Japanese Semiconductor Factory Shipments, Expressed in Yen)

have been added as supplemental data. In this way, both the absolute market size and market size growth rate can be reasonably assessed.

One result of this change is that in this edition Japan shows a much higher dollar growth rate in consumption and factory shipments than was evident in earlier editions. It must be remembered, however, that the true growth rate of Japanese factory shipments between 1977 and 1978 was about 10 percent, when expressed in yen (Table A-14), not the 40 percent growth seen in Table A-8. Much of the growth seen in Table A-8 between 1977 and 1978 was due to the rise in value of the yen against the dollar, from 265 yen per dollar (1977 annual rate) to 207 yen per dollar (1978 annual rate).

Since much of ROW consumption comes from Japan, ROW semiconductor consumption (Table A-5) is also seen to exhibit more rapid growth in the 1976-1978 time period when expressed in dollars.

FORECAST

As mentioned above, historical data is expressed in current dollars. For the consumption forecast, which appears in Tables A-1 to A-5, all estimates for 1979 and beyond are made as if the 1978 monetary conditions were maintained through 1983, i.e., zero inflation and unchanging exchange rates. This means that the forecast is in 1978 constant-value dollars at 1978 exchange rates.

DATAQUEST can make available to clients supplementary data dealing with interregional trade, average selling prices, or other analyses used in the preparation of these tables.

Appendix A—Market Estimate Worksheets

Table A-1

ESTIMATED WORLDWIDE SEMICONDUCTOR CONSUMPTION

(Dollars in Millions)

	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
TOTAL SEMICONDUCTOR	5405	4373	5827	6782	8627	10313	11326	13216	15281	17553
TOTAL I C	2510	2120	2938	3641	5084	6348	7199	8755	10444	12310
BIPOLAR DIGITAL	979	682	905	1070	1359	1617	1750	1984	2268	2568
TTL	719	499	711	863	1070	1240	1278	1420	1613	1859
DTL	105	81	71	55	53	43	33	25	19	15
ECL	73	55	76	94	140	175	223	264	308	363
OTHER	82	47	47	58	96	159	216	275	328	331
MOS	880	837	1229	1553	2289	3023	3541	4498	5516	6632
PMOS	697	609	648	563	599	671	711	650	592	521
NMOS	72	133	377	696	1345	1923	2281	3167	4071	5086
CMOS	111	95	204	274	345	429	549	681	853	1025
LINEAR	651	601	804	1038	1436	1708	1908	2273	2660	3110
INTERFACE	91	75	89	95	123	140	151	174	195	218
CONTROL	247	243	320	408	527	647	739	909	1079	1289
ENTERTAINMENT	182	165	249	347	505	570	604	677	765	857
OTHER	123	118	147	188	281	351	414	513	621	746
HYBRID										
TOTAL DISCRETE	2700	2028	2601	2832	3174	3423	3516	3734	3975	4253
TRANSISTOR	1400	1063	1343	1430	1511	1608	1646	1728	1807	1908
SMALL SIGNAL	874	638	803	811	830	845	851	867	882	896
POWER	526	425	540	619	681	763	795	861	925	1012
DIODE	944	709	904	984	1188	1292	1320	1407	1520	1639
SMALL SIGNAL	323	211	276	295	346	363	361	378	390	403
POWER	482	398	504	559	682	755	782	838	923	1011
ZENER	139	100	124	130	160	174	177	191	207	225
THYRISTOR	232	180	241	291	317	353	369	404	438	474
OTHER	124	76	113	127	158	170	181	195	210	232
OPTOELECTRONIC	195	225	288	309	419	542	611	727	862	990
LED LAMPS	23	32	54	70	89	104	116	131	155	174
LED DISPLAYS	120	128	151	140	193	226	249	295	345	397
COUPLERS	21	22	29	34	51	84	93	109	127	142
OTHER	31	43	54	65	86	128	153	192	235	277

Note: Value of Japanese consumption included in worldwide totals has been translated from yen at exchange rate applicable during period of estimate. See Table A-12 for exchange rates used. European consumption and Rest-of-World consumption has been estimated directly in dollars. Please see Introduction to Appendix A for discussion of terms of forecast.

Source: DATAQUEST, Inc.
Ministry of International Trade and Industry (MITI, Japan)

Appendix A—Market Estimate Worksheets

Table A-2

ESTIMATED NORTH AMERICAN SEMICONDUCTOR CONSUMPTION

(Dollars in Millions)

	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
TOTAL SEMICONDUCTOR	2264	1810	2353	2710	~~3823~~ 3373	~~4001~~ 4456	4363	5061	5837	6696
TOTAL I C	1259	1018	1418	1784	2304	2854	3162	3767	4442	5182
BIPOLAR DIGITAL	573	362	488	584	718	852	910	1010	1147	1278
TTL										
DTL										
ECL										
OTHER										
MOS	442	432	660	845	1151	1491	1710	2155	2629	3155
PMOS										
NMOS										
CMOS										
LINEAR	244	224	270	355	435	511	542	602	666	749
INTERFACE										
CONTROL										
ENTERTAINMENT										
OTHER										
HYBRID										
TOTAL DISCRETE	884	664	791	821	873	948	983	1040	1098	1168
TRANSISTOR	431	339	400	400	420	440	460	482	505	535
SMALL SIGNAL	240	179	208	195	200	210	215	217	220	225
POWER	191	160	192	205	220	230	245	265	285	310
DIODE	297	223	267	285	302	340	345	366	389	413
SMALL SIGNAL	94	52	65	67	70	73	75	78	80	82
POWER	149	128	153	161	172	200	202	218	235	253
ZENER	54	43	49	57	60	67	68	70	74	78
THYRISTOR	81	60	83	100	106	120	128	138	147	158
OTHER	75	42	41	36	45	48	50	54	57	62
OPTOELECTRONIC	121	128	144	105	146	199	218	254	297	346
LED LAMPS	12	13	15	15	20	24	27	29	34	38
LED DISPLAYS	83	86	90	51	76	84	91	106	121	138
COUPLERS	13	13	17	17	20	37	40	46	53	61
OTHER	13	16	22	22	30	54	60	73	89	109

Note: See Introduction to Appendix A for discussion of forecast.

Source: DATAQUEST, Inc.
U.S. Department of Commerce, Bureau of the Census

Appendix A—Market Estimate Worksheets

Table A-3

ESTIMATED JAPANESE SEMICONDUCTOR CONSUMPTION
(Dollars in Millions)

	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
TOTAL SEMICONDUCTOR	1314	1005	1549	1833	2487	2840	3109	3619	4154	4745
TOTAL I C	551	451	713	877	1413	1735	1972	2412	2877	3378
BIPOLAR DIGITAL	135	101	156	190	227	250	270	311	355	407
TTL										
DTL										
ECL										
OTHER										
MOS	248	203	286	328	620	840	985	1248	1541	1843
PMOS										
NMOS										
CMOS										
LINEAR	168	147	271	359	566	645	717	853	981	1128
INTERFACE										
CONTROL										
ENTERTAINMENT										
OTHER										
HYBRID										
TOTAL DISCRETE	731	519	787	876	972	989	1011	1066	1125	1200
TRANSISTOR	424	311	441	477	498	497	501	522	546	579
SMALL SIGNAL	302	189	293	302	308	288	286	288	295	299
POWER	122	122	148	175	190	209	215	234	251	280
DIODE	248	168	266	279	350	352	363	384	406	432
SMALL SIGNAL	97	71	86	83	94	91	91	94	98	102
POWER	125	79	156	171	225	228	236	250	266	283
ZENER	26	18	24	25	31	33	36	40	42	47
THYRISTOR	39	29	51	73	72	82	85	95	103	111
OTHER	20	11	29	47	52	58	62	65	70	78
OPTOELECTRONIC	32	35	49	80	102	116	126	141	152	167
LED LAMPS	4	5	9	8	11	16	15	15	16	17
LED DISPLAYS	16	16	27	42	49	55	57	62	65	71
COUPLERS	3	3	4	7	11	11	11	13	16	17
OTHER	9	11	9	23	31	34	43	51	55	62

Note: Value of Japanese consumption has been translated from yen at exchange rate applicable during period of estimate. See Table A-12 for exchange rates used. See Table A-13 for yen value of Japanese semiconductor consumption, 1973-1983. See introduction to Appendix A for discussion of forecast.

Source: DATAQUEST, Inc.
Ministry of International Trade and Industry (MITI, Japan)

Appendix A—Market Estimate Worksheets

Table A-4
ESTIMATED EUROPEAN SEMICONDUCTOR CONSUMPTION
(Dollars in Millions)

	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
TOTAL SEMICONDUCTOR	1591	1333	1592	1803	2274	2713	2987	3480	4019	4619
TOTAL I C	618	561	673	800	1100	1401	1639	2032	2448	2927
BIPOLAR DIGITAL	229	189	226	259	360	439	485	563	650	752
TTL										
DTL										
ECL										
OTHER										
MOS	168	158	216	274	408	560	700	920	1148	1415
PMOS										
NMOS										
CMOS										
LINEAR	221	214	231	267	332	402	454	549	650	760
INTERFACE										
CONTROL										
ENTERTAINMENT										
OTHER										
HYBRID										
TOTAL DISCRETE	944	728	852	913	1059	1164	1183	1251	1338	1428
TRANSISTOR	463	351	410	442	465	510	518	543	562	585
SMALL SIGNAL	289	243	258	262	262	280	284	292	295	298
POWER	174	108	152	180	203	230	234	251	267	287
DIODE	362	282	309	344	442	490	495	527	581	634
SMALL SIGNAL	112	72	107	123	152	168	162	170	174	179
POWER	194	173	163	187	239	265	278	297	340	382
ZENER	56	37	39	34	51	57	55	60	67	73
THYRISTOR	100	82	99	99	113	123	126	136	147	158
OTHER	19	13	34	28	39	41	44	45	48	51
OPTOELECTRONIC	29	44	67	90	115	148	165	197	233	264
LED LAMPS	6	10	23	32	40	46	51	57	65	71
LED DISPLAYS	13	17	22	40	50	64	71	86	100	118
COUPLERS	4	5	5	7	12	18	20	24	27	30
OTHER	6	12	17	11	13	20	23	30	41	45

Note: Value of European consumption has been estimated directly in dollars. See Introduction to Appendix A for discussion of forecast.

Source: DATAQUEST, Inc.

Appendix A—Market Estimate Worksheets

Table A-5

ESTIMATED REST OF WORLD SEMICONDUCTOR CONSUMPTION

(Dollars in Millions)

	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
TOTAL SEMICONDUCTOR	236	225	333	436	593	759	867	1056	1271	1493
TOTAL I C	82	90	134	180	267	358	426	544	677	823
BIPOLAR DIGITAL	42	30	35	37	54	76	85	100	116	131
TTL										
DTL										
ECL										
OTHER										
MOS	22	44	67	86	110	132	146	175	198	219
PMOS										
NMOS										
CMOS										
LINEAR	18	16	32	57	103	150	195	269	363	473
INTERFACE										
CONTROL										
ENTERTAINMENT										
OTHER										
HYBRID										
TOTAL DISCRETE	141	117	171	222	270	322	339	377	414	457
TRANSISTOR	82	62	92	111	128	161	167	181	194	209
SMALL SIGNAL	43	27	44	52	60	67	66	70	72	74
POWER	39	35	48	59	68	94	101	111	122	135
DIODE	37	36	62	76	94	110	117	130	144	160
SMALL SIGNAL	20	16	18	22	30	31	33	36	38	40
POWER	14	18	32	40	46	62	66	73	82	93
ZENER	3	2	12	14	18	17	18	21	24	27
THYRISTOR	12	9	8	19	26	28	30	35	41	47
OTHER	10	10	9	16	22	23	25	31	35	41
OPTOELECTRONIC	13	18	28	34	56	79	102	135	180	213
LED LAMPS	1	4	7	11	18	18	23	30	40	48
LED DISPLAYS	8	9	12	11	18	23	30	41	59	70
COUPLERS	1	1	3	3	8	18	22	26	31	34
OTHER	3	4	6	9	12	20	27	38	50	61

Note: Value of Rest-of-World consumption has been estimated directly in dollars and translated from yen using exchange rate applicable during period of estimate. See Introduction to Appendix A for discussion of forecast.

Source: DATAQUEST, Inc.

Appendix A—Market Estimate Worksheets

Table A-6
ESTIMATED WORLDWIDE SEMICONDUCTOR FACTORY SHIPMENTS
(Dollars in Millions)

	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978
TOTAL SEMICONDUCTOR	2395	2505	2459	3142	4798	5405	4373	5827	6782	8677
TOTAL I C	654	801	892	1244	2046	2510	2120	2938	3641	5084
BIPOLAR DIGITAL	396	412	447	538	921	979	682	905	1070	1359
TTL	169	169	225	349	658	719	499	711	863	1070
DTL	141	144	116	98	121	105	81	71	55	53
ECL	28	53	62	58	65	73	55	76	94	140
OTHER	58	46	44	33	77	82	47	47	58	96
MOS	29	97	156	276	585	880	837	1229	1533	2289
PMOS	28	94	147	260	516	697	609	648	563	599
NMOS	0	0	2	4	13	72	133	377	696	1345
CMOS	1	3	7	12	56	111	95	204	274	345
LINEAR	229	292	289	430	540	651	601	804	1038	1436
INTERFACE				47	72	91	75	89	95	123
CONTROL				190	210	247	243	320	408	527
ENTERTAINMENT				99	152	182	165	248	347	505
OTHER				94	106	131	118	147	188	281
HYBRID										
TOTAL DISCRETE	1697	1656	1515	1791	2586	2700	2028	2601	2832	3174
TRANSISTOR	830	824	794	935	1377	1400	1063	1343	1430	1511
SMALL SIGNAL	559	538	497	595	863	874	638	803	811	830
POWER	271	286	297	340	514	526	425	540	619	681
DIODE	670	633	537	640	887	944	709	904	984	1188
SMALL SIGNAL	279	243	169	205	291	323	211	276	295	346
POWER	293	298	296	346	480	482	398	504	559	682
ZENER	98	92	72	89	116	139	100	124	130	160
THYRISTOR	115	118	107	123	202	232	180	241	291	317
OTHER	82	81	77	93	120	124	76	113	127	158
OPTOELECTRONIC	44	48	52	107	166	195	225	288	309	419
LED LAMPS		6	6	15	22	23	32	54	66	89
LED DISPLAYS		13	21	55	104	120	128	151	144	193
COUPLERS		1	2	7	15	21	22	29	34	51
OTHER		28	23	30	25	31	43	54	65	86

Note: Value of Japanese factory shipments included in worldwide totals have been translated from yen using exchange rate applicable during period of estimate. See Table A-12 for exchange rates used. Value of European and Rest-of-World factory shipments have been made directly in U.S. dollars.

Source: DATAQUEST, Inc.
Ministry of International Trade and Industry (MITI, Japan)

Appendix A—Market Estimate Worksheets

Table A-7
ESTIMATED NORTH AMERICAN SEMICONDUCTOR FACTORY SHIPMENTS
(Dollars in Millions)

	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978
TOTAL SEMICONDUCTOR	1327	1210	1161	1498	2209	2626	2119	2665	3074	3790
TOTAL I C	498	524	537	749	1192	1499	1216	1612	2029	2659
BIPOLAR DIGITAL	326	287	263	342	556	595	395	505	623	780
TTL	142	116	135	224	428	470	303	410	537	680
DTL	114	100	69	63	61	49	43	41	34	33
ECL	23	34	38	36	41	45	33	39	40	57
OTHER	47	37	21	19	26	31	16	15	12	10
MOS	21	75	101	169	383	595	538	791	985	1348
PMOS	20	72	93	156	323	435	353	327	242	240
NMOS	0	0	2	4	12	66	108	301	525	850
CMOS	1	3	6	9	48	94	77	163	218	258
LINEAR	151	162	173	238	253	309	283	316	421	531
INTERFACE										
CONTROL										
ENTERTAINMENT										
OTHER										
HYBRID										
TOTAL DISCRETE	792	653	587	678	896	983	751	889	915	970
TRANSISTOR	363	290	303	358	440	468	368	418	437	475
SMALL SIGNAL	233	175	178	208	230	254	189	225	225	239
POWER	130	115	125	150	210	214	179	193	212	236
DIODE	307	256	189	210	286	327	256	300	313	346
SMALL SIGNAL	143	104	51	47	73	95	62	73	78	80
POWER	108	101	102	119	159	169	142	164	171	196
ZENER	56	51	36	44	54	63	52	63	64	70
THYRISTOR	63	60	54	64	95	102	75	104	113	110
OTHER	59	47	41	46	75	86	52	67	52	39
OPTOELECTRONIC	37	33	37	71	121	144	152	164	130	161
LED LAMPS		5	5	9	13	13	15	19	23	25
LED DISPLAYS		11	18	46	83	98	98	99	67	80
COUPLERS		1	2	5	11	15	14	20	20	28
OTHER		16	12	11	14	18	25	26	20	28

Source: DATAQUEST, Inc.

Appendix A—Market Estimate Worksheets

Table A-8

ESTIMATED JAPANESE SEMICONDUCTOR FACTORY SHIPMENTS
(Dollars in Millions)

	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978
TOTAL SEMICONDUCTOR	425	642	583	826	1322	1199	925	1521	1826	2569
TOTAL I C	73	141	147	240	432	429	396	665	804	1357
BIPOLAR DIGITAL	29	59	55	50	95	108	76	106	140	197
TTL										
DTL										
ECL										
OTHER										
MOS	7	17	44	82	163	160	186	290	332	635
PMOS	7	17	43	80	157	146	154	200	180	185
NMOS	0	0	0	0	1	4	19	60	118	395
CMOS	0	0	1	2	5	10	13	30	34	55
LINEAR	37	65	48	108	174	161	134	269	332	525
INTERFACE										
CONTROL										
ENTERTAINMENT										
OTHER										
HYBRID										
TOTAL DISCRETE	352	492	427	563	869	754	507	818	953	1108
TRANSISTOR	205	285	243	312	500	439	305	474	520	559
SMALL SIGNAL	136	189	151	213	362	310	189	302	316	340
POWER	69	96	92	99	138	129	116	172	204	219
DIODE	117	169	152	203	296	248	164	277	319	398
SMALL SIGNAL	45	64	47	68	102	88	58	88	96	120
POWER	64	92	94	120	171	134	88	162	193	235
ZENER	8	13	11	15	23	26	18	27	30	43
THYRISTOR	19	29	23	25	50	46	27	46	70	86
OTHER	11	9	9	23	23	21	11	21	44	65
OPTOELECTRONIC	0	9	9	23	21	16	22	38	69	104
LED LAMPS		0	0	2	3	2	3	6	6	13
LED DISPLAYS		1	2	7	12	8	10	21	33	53
COUPLERS		0	0	1	2	2	3	3	3	8
OTHER		8	7	13	4	4	6	8	27	30

Note: Value of Japanese factory shipments have been translated from yen using exchange rate applicable during period of estimate. See Table A-12 for exchange rate applicable during period of estimate. See Table A-14 for estimated value of Japanese factory shipments for 1969-1978 expressed in yen.

Source: DATAQUEST, Inc.
Ministry of International Trade and Industry (MITI, Japan)

Appendix A—Market Estimate Worksheets

Table A-9
ESTIMATED EUROPEAN SEMICONDUCTOR FACTORY SHIPMENTS
(Dollars in Millions)

	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978
TOTAL SEMICONDUCTOR	633	641	698	789	1195	1448	1209	1443	1687	2060
TOTAL I C	83	136	206	250	403	531	457	556	702	926
BIPOLAR DIGITAL	41	66	127	141	252	246	181	227	248	314
TTL										
DTL										
ECL										
OTHER										
MOS	1	5	11	25	39	122	108	142	207	284
PMOS	1	5	11	24	36	113	97	115	134	159
NMOS	0	0	0	0	0	2	6	16	51	93
CMOS	0	0	0	1	3	7	5	11	22	32
LINEAR	41	65	68	84	112	163	168	187	247	328
INTERFACE										
CONTROL										
ENTERTAINMENT										
OTHER										
HYBRID										
TOTAL DISCRETE	543	499	486	527	771	893	717	826	889	997
TRANSISTOR	256	241	238	250	396	443	350	395	414	405
SMALL SIGNAL	184	166	158	159	230	260	220	225	217	189
POWER	72	75	80	91	166	183	130	170	197	216
DIODE	242	204	191	219	296	349	276	315	338	424
SMALL SIGNAL	87	71	66	82	107	120	78	103	107	129
POWER	121	105	100	107	150	179	168	178	195	248
ZENER	34	28	25	30	39	50	30	34	36	47
THYRISTOR	33	29	30	34	57	84	78	91	107	118
OTHER	12	25	27	24	22	17	13	25	30	50
OPTOELECTRONIC	7	6	6	12	21	24	35	61	96	137
LED LAMPS		1	1	4	6	6	10	23	34	47
LED DISPLAYS		1	1	2	7	9	13	20	39	53
COUPLERS		0	0	1	2	3	3	4	9	13
OTHER		4	4	5	6	6	9	14	14	24

Note: Value of European factory shipments have been estimated directly in U.S. dollars.

Source: DATAQUEST, Inc.

Table A-10

ESTIMATED REST OF WORLD SEMICONDUCTOR FACTORY SHIPMENTS
(Dollars in Millions)

	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978
TOTAL SEMICONDUCTOR	10	12	17	29	72	132	120	198	195	258
TOTAL I C	0	0	2	5	19	51	51	105	106	142
BIPOLAR DIGITAL	0	0	2	5	18	30	30	67	59	68
TTL										
DTL										
ECL										
OTHER										
MOS	0	0	0	0	0	3	5	6	9	22
PMOS	0	0	0	0	0	3	5	6	9	11
NMOS	0	0	0	0	0	0	0	0	0	8
CMOS	0	0	0	0	0	0	0	0	0	3
LINEAR	0	0	0	0	1	18	16	32	38	52
INTERFACE										
CONTROL										
ENTERTAINMENT										
OTHER										
HYBRID										
TOTAL DISCRETE	10	12	15	23	50	70	53	68	75	99
TRANSISTOR	6	8	10	15	41	50	40	56	59	72
SMALL SIGNAL	6	8	10	15	41	50	40	51	53	62
POWER	0	0	0	0	0	0	0	5	6	10
DIODE	4	4	5	8	9	20	13	12	14	20
SMALL SIGNAL	4	4	5	8	9	20	13	12	14	17
POWER	0	0	0	0	0	0	0	0	0	3
ZENER	0	0	0	0	0	0	0	0	0	0
THYRISTOR	0	0	0	0	0	0	0	0	1	3
OTHER	0	0	0	0	0	0	0	0	1	4
OPTOELECTRONIC	0	0	0	1	3	11	16	25	14	17
LED LAMPS	0	0	0	0	0	2	4	6	3	4
LED DISPLAYS	0	0	0	0	2	5	7	11	5	7
COUPLERS	0	0	0	0	0	1	2	2	2	2
OTHER	0	0	0	1	1	3	3	6	4	4

Note: Value of Rest-of-World factory shipments have been estimated directly in U.S. dollars.

Source: DATAQUEST, Inc.

Table A-11

ESTIMATED WORLDWIDE SEMICONDUCTOR CONSUMPTION

(Units in Millions)

	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
TOTAL SEMICONDUCTOR	6881	7385	8287	11253	16266	18855	14913	19210	21853	27254	30068	31605	34483	37730	40807
TOTAL I C	383	541	751	1199	1972	2422	2116	2954	3662	5113	5936	6571	7654	8828	10101
BIPOLAR DIGITAL	268.5	353.9	521.6	749.3	1328	1517	1146	1494	1635	2232	2488	2574	2794	3024	2310
TTL	91.1	127.7	294.9	491.5	982	1219	902	1261	1400	1986					
DTL	118.5	167.4	165.7	200.0	246	171	150	109	71	50					
ECL	9.7	20.1	23.4	23.8	35	60	55	83	104	126					
OTHER	49.2	38.7	37.6	34.0	65	67	39	41	60	75					
MOS	3.4	13.9	21.8	45.6	110	217	304	515	748	1208	1550	1967	2541	3170	3901
PMOS	3.3	13.6	20.6	41.9	84	128	152	155	189	310					
NMOS	0.0	0.0	0.2	0.7	4	15	30	80	156	306					
CMOS	0.1	0.3	1.0	3.0	22	74	122	280	403	592					
LINEAR	111.3	172.7	208.5	404.0	534	688	666	945	1279	1673	1898	2030	2319	2634	2990
INTERFACE				30.3	50	67	61	82	87	105					
CONTROL				154.5	187	246	253	354	492	592					
ENTERTAINMENT				112.4	203	249	228	349	495	665					
OTHER				106.8	94	126	124	160	215	311					
HYBRID															
TOTAL DISCRETE	6498	6830	7514	9973	14160	16242	12536	15825	17510	21013	24132	25034	26829	28902	30706
TRANSISTOR	2318	2321	2465	3364	5115	5740	4796	6731	7387	8578	8933	9144	9600	10038	10092
SMALL SIGNAL	2089	2050	2158	2985	4511	5029	4173	5992	6575	7575					
POWER	229	271	307	379	604	711	623	739	812	954					
DIODE	4083	4407	4917	6419	8736	10136	7448	8694	9620	11883	12920	13200	14070	15200	16390
SMALL SIGNAL	2870	3188	3520	4120	5540	6440	4220	4317	4683	5723					
POWER	1017	1019	1188	1928	2682	3006	2640	3564	4090	5188					
ZENER	196	200	209	371	514	690	588	813	847	972					
THYRISTOR	77	92	94	128	222	269	217	272	321	350	387	401	439	471	510
OTHER DISCRETE	10	10	38	62	87	97	75	128	182	251	298	348	375	412	464
OPTOELECTRONIC	10	14	22	82	134	191	261	431	681	1128	1594	1971	2345	2781	3300

Source: DATAQUEST, Inc.

Appendix A—Market Estimate Worksheets

Table A-12

ANNUAL FOREIGN EXCHANGE RATES
(Expressed in U.S. Dollars)

Year	Japan: Dollars Per Yen	France: Dollars Per French Franc	Germany: Dollars Per Deutsch mark	United Kingdom: Dollars Per Pound Sterling
1970	0.002795	0.1810	0.2744	2.3963
1971	0.002913	0.1822	0.2886	2.4506
1972	0.003311	0.1985	0.3140	2.4878
1973	0.003721	0.2267	0.3811	2.4587
1974	0.003427	0.2099	0.3897	2.3524
1975	0.003368	0.2337	0.4063	2.2069
1976	0.003376	0.2091	0.3998	1.7960
1977	0.003761	0.2042	0.4337	1.7602
1978	0.004822	0.2233	0.5012	1.9280
April 30, 1979	0.004507	0.2290	0.5277	2.0700

Source: Federal Reserve Bulletin
DATAQUEST, Inc.

Appendix A—Market Estimate Worksheets

Table A-13
ESTIMATED JAPANESE SEMICONDUCTOR CONSUMPTION
(Yen in Billions)

	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
TOTAL SEMICONDUCTOR	383.4	298.4	458.8	487.4	515.7	589.0	644.3	748.1	855.6	970.9
TOTAL I C	160.8	134.0	211.2	233.2	293.0	357.9	409.0	500.1	596.6	700.5
BIPOLAR DIGITAL	39.4	30.0	46.2	50.5	47.0	51.8	56.0	64.5	73.6	84.4
TTL										
DTL										
ECL										
OTHER										
MOS	72.4	60.4	84.7	87.2	128.6	174.2	204.5	258.8	319.6	382.2
PMOS										
NMOS										
CMOS										
LINEAR	49.0	43.6	80.3	95.5	117.4	134.0	148.7	176.8	203.4	233.9
INTERFACE										
CONTROL										
ENTERTAINMENT										
OTHER										
HYBRID										
TOTAL DISCRETE	213.3	154.0	233.1	232.9	192.2	205.1	209.2	218.8	227.5	235.8
TRANSISTOR	123.7	92.3	130.6	128.6	103.3	103.1	104.9	108.3	113.2	120.0
SMALL SIGNAL	88.1	56.1	86.8	80.3	63.9	59.7	59.3	59.7	61.1	62.0
POWER	35.6	36.2	43.8	46.5	39.4	43.3	45.4	48.5	52.1	58.1
DIODE	72.4	50.0	78.8	74.2	72.6	73.0	75.3	79.6	84.2	89.6
SMALL SIGNAL	28.4	21.0	25.5	22.1	19.5	18.9	18.9	19.5	20.3	21.1
POWER	36.4	23.5	46.2	45.5	46.6	47.3	48.9	51.8	52.2	58.7
ZENER	7.6	5.4	7.1	6.7	6.4	6.8	7.5	8.3	8.7	9.7
THYRISTOR	11.4	8.6	15.1	19.4	15.0	17.0	17.6	19.7	21.4	23.0
OTHER	5.8	3.3	8.6	12.5	10.7	12.0	12.8	13.5	21.4	16.2
OPTOELECTRONIC	9.3	10.4	14.5	21.3	21.2	24.1	26.1	29.2	31.5	34.6
LED LAMPS	1.2	1.5	2.7	2.1	2.3	3.3	3.1	3.1	3.3	3.5
LED DISPLAYS	4.7	4.8	8.0	11.2	10.2	11.4	11.8	12.8	13.5	14.7
COUPLERS	0.9	0.9	1.2	1.9	2.3	2.3	2.3	2.7	3.3	3.5
OTHER	2.6	3.3	2.7	6.1	6.4	7.1	8.9	10.6	11.4	12.9

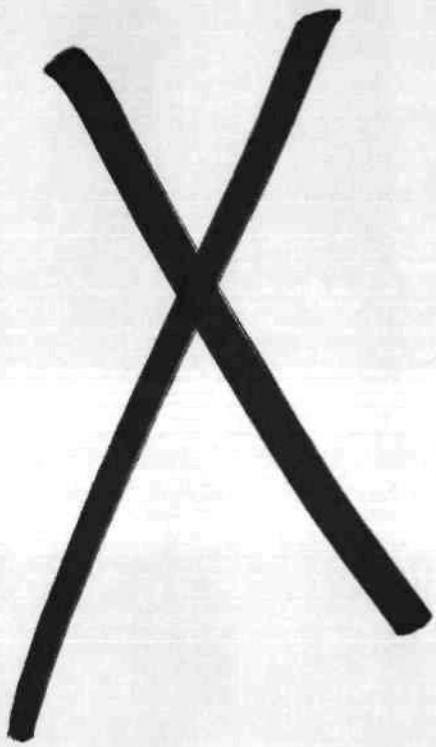
Source: DATAQUEST, Inc.
Ministry of International Trade and Industry (MITI, Japan)

Appendix A—Market Estimate Worksheets

Table A-14
ESTIMATED JAPANESE SEMICONDUCTOR FACTORY SHIPMENTS
(Yen in Billions)

	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978
TOTAL SEMICONDUCTOR	153.0	232.8	200.0	247.2	355.3	347.1	276.4	450.5	483.8	532.7
TOTAL I C	26.3	50.4	50.8	72.3	112.3	125.3	117.6	197.1	212.3	281.4
BIPOLAR DIGITAL	10.4	21.1	18.9	15.1	24.6	31.4	22.6	31.5	37.2	40.9
TTL										
DTL										
ECL										
OTHER										
MOS	2.5	6.1	15.1	24.5	42.8	46.7	55.2	85.8	86.9	131.7
PMOS	2.5	6.1	14.8	23.9	41.2	42.6	45.7	59.1	46.4	38.4
NMOS	0.0	0.0	0.0	0.0	0.3	1.2	5.6	17.7	31.4	81.9
CMOS	0.0	0.0	0.3	0.6	1.3	2.9	3.9	8.9	9.0	11.4
LINEAR	13.3	23.3	16.7	32.6	44.9	47.2	39.7	79.7	88.2	108.8
INTERFACE										
CONTROL										
ENTERTAINMENT										
OTHER										
HYBD										
TOTAL DISCRETE	126.7	179.1	146.2	170.0	227.3	216.6	151.5	242.7	253.2	229.7
TRANSISTOR	73.8	105.0	83.2	94.2	129.2	128.2	90.5	140.3	138.4	115.9
SMALL SIGNAL	49.0	70.7	51.7	64.3	93.1	90.6	56.2	89.4	84.0	70.5
POWER	24.8	34.3	31.5	29.9	37.1	37.6	34.4	50.9	54.4	45.4
DIODE	42.1	60.5	52.0	61.3	79.5	68.9	48.7	82.6	84.8	82.5
SMALL SIGNAL	16.2	22.9	16.1	20.5	27.4	25.7	17.2	26.6	25.5	24.8
POWER	23.0	32.9	32.2	36.2	45.9	35.6	26.1	48.0	51.3	48.7
ZENER	2.9	4.6	3.8	4.5	6.2	7.6	5.4	8.0	7.9	8.9
THYRISTOR	6.8	10.4	7.9	7.5	12.4	13.4	8.0	13.6	18.5	17.8
OTHER	3.9	3.2	3.1	6.9	6.2	6.1	4.2	6.2	11.6	13.5
OPTOELECTRONIC	0.0	3.2	3.1	4.9	5.6	5.2	7.3	14.5	18.2	21.6
LED LAMPS							0.9	1.8	1.6	2.7
LED DISPLAYS							2.9	6.2	8.6	11.0
COUPLERS							2.7	0.9	0.8	1.6
OTHER							2.6	5.6	7.2	6.2

Source: DATAQUEST, Inc.
Ministry of International
Trade and Industry (MITI, Japan)



Appendix A—Market Estimate Worksheets

INTRODUCTION

Appendix A consists of a set of detailed tables that estimate semiconductor consumption and semiconductor factory shipments both worldwide and for four major geographical regions. Table A-1 details world semiconductor consumption. Tables A-2 through A-5 estimate semiconductor consumption for four geographical regions—North America, Western Europe, Japan, and the Rest of the World (ROW), respectively.

Table A-6 details world factory shipments of semiconductors. Tables A-7 through A-10 estimate semiconductor productions in North America, Western Europe, Japan, and the Rest of the World. The differences between Tables A-2 through A-5 and Tables A-7 through A-10 for each geographic region, represent the net exports or imports of those regions.

Each table gives estimates for semiconductor consumption or shipments listed by the major product categories of semiconductor devices. In these tables, semiconductor components are divided into three major product groups: integrated circuits, discrete devices, and optoelectronic devices. Each of these groups is divided into a number of subgroups, some of which are further segmented. Totals for each device group or subgroup are presented at the top of each category. In general, these product divisions are self-explanatory. The difference between low-power and high-power transistors is set at the 1-watt power handling capability. Power diodes are rated at 1 amp or higher, while small signal diodes are rated at less than 1 amp.

Special discrete devices that are neither transistors, diodes, nor thyristors are categorized as "Other."

DEFINITIONS AND CONVENTIONS

DATAQUEST utilizes a common basis of manufacturers for all data tables. This basis includes all noncaptive suppliers to the semiconductor market. It excludes captive suppliers that manufacture devices solely for the benefit of the parent company, such as Burroughs, IBM, NCR, and Western Electric. Included, however, are companies that actively market semiconductor devices to industry as well as to other divisions of their own company. For these companies, both external shipments and internal consumption are included. Devices that are used internally are valued at current market prices.

For purposes of Appendix A, consumption is defined as the purchase of a semiconductor device or devices. This definition must be differentiated from actual use of the device in a final product. Devices that are inventoried at the user level are considered consumption according to our definition.

The fabrication and assembly of a semiconductor device may be performed in several different locations. For the purposes of this database, factory shipments are defined geographically as occurring from that point where the device was tested and marked, irrespective of where the device was assembled or where the initial wafer

fabrication was performed. In general, factory shipments and production are equated, but devices inventoried at the manufacturer's level are not included in DATAQUEST's basis for factory shipments.

In earlier editions, hybrid devices were included as a separate segment of integrated circuits. However, since hybrid devices are primarily a special packaging arrangement, this segment has been omitted and those hybrids manufactured by semiconductor companies are now included in the most appropriate product segment.

The detailed definitions of basis we have used in our tables may differ from those used in other studies of this type. Our basis is nearly the same as that used by the Semiconductor Industry Association (SIA), but is different from that used by many companies and certain assumptions or conventions implicit in our forecast may differ from the forecasts of others.

North America is defined as including both the United States and Canada. Latin America, including Mexico, is considered in the ROW category.

DATA SOURCES

No single official source of information on worldwide production and trade in semiconductors exists. The information presented in Appendix A has been consolidated from a wide variety of fragmentary sources, each of which focuses on a specific part of the market.

Historical U.S. data prior to 1973 rely to a large degree on data collected by the Electronics Industry Association (EIA). More recent data are compiled from a variety of published and nonpublished sources.

There is no single source of data on European semiconductor production. For European markets, U.S. Department of Commerce trade statistics, marketing statistics from the Semiconductor Industry Association (SIA), and shipment estimates for each individual company are the primary data sources used.

In Japan, many statistics are compiled and published by the Ministry of International Trade and Industry (MITI).

U.S. Commerce Department trade statistics and MITI trade statistics constitute the major published sources used to estimate ROW consumption and factory shipments.

It should be clear from the broad scope and detailed breakdown of the tables included here that their development is a major effort. We believe that the estimates presented are the most accurate and meaningful generally available today. The sources of the data presented in the tables are:

- Unit sales or revenues (or both) published by major industry participants, both in the United States and abroad

Appendix A—Market Estimate Worksheets

- Estimates presented by knowledgeable and reliable industry spokesmen
- Government data or trade association data such as EIA, MITI, SIA, and the U.S. Department of Commerce
- Published product literature and price lists
- Interviews with knowledgeable manufacturers, distributors, and users
- Relevant projected world economic data

CONSISTENCY

One of the key objectives in preparing these estimates has been to achieve consistency among the various data elements that constitute the forecast and the past database. To ensure the accuracy and consistency of the estimates, we have compared the value of directly obtained data elements with values obtained by indirect means wherever possible. Thus, the data in Appendix A are consistent with the Market Share estimates in Appendix B and with the individual company revenue breakdowns presented in Chapters 8, 9, and 10, as well as with summary tables presented in Chapter 2, "Semiconductor Markets."

ACCURACY

The tables presented here represent DATAQUEST estimates that we believe are reasonably accurate. Where we have no reasonable estimate, none is given. A blank space in a table indicates the unavailability of a reasonably accurate estimate, and a zero in a table represents an estimate.

VALUATION OF CONSUMPTION AND FACTORY SHIPMENTS

Regional Consumption and Factory Shipments amounts are expressed in U.S. dollars. To make the tables of Appendix A useful in comparing different regions, it is necessary to express all values in a common currency and, because of U.S. producers' large presence in international markets, the dollar is the preferred choice.

However, the choice of the U.S. dollar (or any single currency, for that matter) as the currency basis for the tables, brings with it some problems that require the readers' careful consideration in interpreting the data.

Appendix A—Market Estimate Worksheets

Inflation

All countries that participate significantly in international semiconductor markets have, to a greater or lesser extent, suffered from an overall price inflation in the 1970s.

As a consequence, the dollar in a given year is not truly comparable with the dollar in any preceding year. Consumer and Wholesale Price Indices and GNP Deflators all measure price changes in various composite "market baskets" of goods. However, there is no price index that measures price changes of material and labor inputs to the semiconductor industry. Indeed, the "mix" is changing so rapidly that what is used this year was sometimes unavailable last year, at any price. Nor is there a composite price index that measures price changes in aggregate semiconductor product. In an industry noted for its deflationary trends, this latter effect would tend to make the component purchaser's dollar worth more as time passed in terms of purchasing electronic capability.

We have made no adjustments in the historical data to account for these inflationary and deflationary effects. The data are expressed in current dollars for all historical data, and comparisons between different years must be interpreted accordingly.

Exchange Rates

Construction of the tables requires combining data from many countries, each of which has different and changing exchange rates. This situation raises a related issue of how to express foreign production in terms of current U.S. dollars.

Because approximately 50 percent of European consumption is produced by U.S. companies, estimates of overall European market dimensions by DATAQUEST have always been made directly in dollars.

However, Japanese consumption and factory shipments have been based on MITI data, which are originally expressed in yen. The yen/dollar exchange rate for each year can be found in Table A-0 at the end of this introduction. Tables A-3 and A-8 give Japanese consumption and factory shipments in dollars at the appropriate exchange rate for each year. Tables A-12 and A-13 give the same information expressed in yen. Because of the fluctuations in the exchange rate, the dollar values given tend to distort the growth rate of the Japanese market but they do provide a useful basis for regional comparisons. The data in yen give a better picture of the real growth in the Japanese market.

FORECAST

As mentioned previously, historical data are expressed in current dollars. For the consumption forecast, which appears in Tables A-1 through A-5, all estimates for

Appendix A—Market Estimate Worksheets

1980 and beyond are made as if 1979 monetary conditions will continue through 1984; i.e., zero inflation and unchanging exchange rates. This means that the forecast is in 1979 constant-value dollars at 1979 exchange rates.

Information on interregional trade, average selling prices, and other analyses used in the preparation of these tables is available to DATAQUEST clients upon request.

Frederick L. Zieber
Jean Page

Table A-0

ANNUAL FOREIGN EXCHANGE RATES
(Expressed in U.S. Dollars)

Year	Japan: Dollars Per Yen	France: Dollars Per French Franc	Germany: Dollars Per Deutsch Mark	United Kingdom: Dollars Per Pound Sterling
1970	$0.002795 358	$0.1810	$0.2744	$2.3963
1971	$0.002913 343	$0.1822	$0.2886	$2.4506
1972	$0.003311 302	$0.1985	$0.3140	$2.4878
1973	$0.003721 269	$0.2267	$0.3811	$2.4587
1974	$0.003427 292	$0.2099	$0.3897	$2.3524
1975	$0.003368 297	$0.2337	$0.4063	$2.2069
1976	$0.003376 296	$0.2091	$0.3998	$1.7960
1977	$0.003761 266	$0.2042	$0.4337	$1.7602
1978	$0.004857 206	$0.2251	$0.5051	$2.0260
1979	$0.004518 221	$0.2361	$0.5482	$2.1312
Jan-June average, 1980	$0.004231	$0.2385	$0.5557	$2.2778

Source: Federal Reserve Bulletin
DATAQUEST, Inc.

Appendix A—Market Estimate Worksheets

Table A-1

ESTIMATED WORLDWIDE SEMICONDUCTOR CONSUMPTION
(Millions of Dollars)

	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
TOTAL SEMICONDUCTOR	4373	5827	6846	8859	11116	13532	14978	17733	21886	25926
TOTAL I C	2120	2938	3687	5235	7126	9246	10523	12770	16112	19456
BIPOLAR DIGITAL	682	905	1084	1405	1799	2260	2504	2967	3663	4353
TTL	499	711	879	1120	1482	1894	2108	2510	3110	3705
DTL	81	71	55	53	45	31	22	16	13	10
ECL	55	76	94	140	160	194	209	243	293	339
OTHER	47	47	56	92	112	145	165	198	247	299
MOS	837	1229	1539	2309	3430	4828	5635	6985	9001	11084
PMOS	609	648	569	595	660	765	740	720	700	670
NMOS	133	377	696	1366	2211	3270	3956	5062	6701	8401
CMOS	95	204	274	348	559	793	939	1203	1600	2013
LINEAR	601	804	1064	1521	1897	2154	2384	2818	3448	4019
INTERFACE	75	89	95	123	160	182	201	238	291	339
CONTROL	243	320	408	537	718	815	902	1066	1304	1520
ENTERTAINMENT	165	248	373	580	669	740	797	918	1096	1224
OTHER	118	147	188	281	350	417	484	596	757	936
HYBRID										
TOTAL DISCRETE	2028	2601	2850	3205	3395	3575	3669	3960	4514	4923
TRANSISTOR	1063	1343	1447	1557	1581	1621	1659	1792	2030	2198
SMALL SIGNAL	638	803	817	861	827	849	852	905	1001	1056
POWER	425	540	630	696	754	772	807	887	1029	1142
DIODE	709	904	977	1173	1271	1378	1414	1513	1711	1853
SMALL SIGNAL	211	276	279	316	352	378	381	390	428	449
POWER	398	504	569	682	736	815	842	926	1068	1178
ZENER	100	124	129	175	183	185	191	197	215	226
THYRISTOR	180	241	295	317	358	409	421	461	542	606
OTHER	76	113	131	158	185	167	175	194	231	266
OPTOELECTRONIC	225	288	309	419	595	711	798	1003	1260	1547
LED LAMPS	32	54	66	89	113	136	150	183	220	264
LED DISPLAYS	128	151	144	193	265	315	351	434	539	647
COUPLERS	22	29	34	51	81	97	106	131	161	193
OTHER	43	54	65	86	136	163	191	255	340	443

Note: Please see Introduction to Appendix A for discussion of terms and definitions of forecast.
Exchange rates are given in Table A-0 at the end of the Introduction.

Source: DATAQUEST, Inc.

Appendix A—Market Estimate Worksheets

Table A-2

ESTIMATED NORTH AMERICAN SEMICONDUCTOR CONSUMPTION
(Millions of Dollars)

	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
TOTAL SEMICONDUCTOR	1810	2353	2720	3414	4697	5907	6585	7660	9380	10955
TOTAL I C	1018	1418	1784	2354	3375	4485	5076	6058	7544	8916
BIPOLAR DIGITAL	362	488	584	718	966	1252	1371	1590	1940	2251
TTL										
DTL										
ECL										
OTHER										
MOS	432	660	845	1151	1780	2542	2944	3587	4551	5481
PMOS										
NMOS										
CMOS										
LINEAR	224	270	355	485	629	691	761	881	1053	1184
INTERFACE										
CONTROL										
ENTERTAINMENT										
OTHER										
HYBRID										
TOTAL DISCRETE	664	791	831	914	1095	1157	1170	1246	1407	1509
TRANSISTOR	339	400	405	451	521	541	547	583	659	703
SMALL SIGNAL	179	208	194	219	241	246	246	259	280	292
POWER	160	192	211	232	280	295	301	324	379	411
DIODE	223	267	290	312	376	425	429	454	506	539
SMALL SIGNAL	52	65	60	55	61	71	71	72	77	80
POWER	128	153	174	182	235	284	287	309	350	377
ZENER	43	49	56	75	80	70	71	73	79	82
THYRISTOR	60	83	100	106	130	140	142	152	176	192
OTHER	42	41	36	45	68	51	52	57	66	75
OPTOELECTRONIC	128	144	105	146	227	265	289	356	439	530
LED LAMPS	13	15	13	20	29	34	36	42	48	55
LED DISPLAYS	86	90	53	76	98	114	123	148	178	206
COUPLERS	13	17	17	20	43	50	53	65	80	94
OTHER	16	22	22	30	57	67	77	101	133	175

Note: Please see Introduction to Appendix A for discussion of terms and definitions of forecast.

Source: DATAQUEST, Inc.
U.S. Department of Commerce, Bureau of the Census
Semiconductor Industry Association (SIA)

Table A-3

ESTIMATED JAPANESE SEMICONDUCTOR CONSUMPTION
(Millions of Dollars)

	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
TOTAL SEMICONDUCTOR	1005	1549	1833	2487	2656	3111	3507	4212	5264	6356
TOTAL I C	451	713	877	1413	1696	2114	2465	3040	3870	4766
BIPOLAR DIGITAL	101	156	190	227	237	265	302	373	469	571
TTL										
DTL										
ECL										
OTHER										
MOS	203	286	328	620	904	1211	1449	1817	2351	2952
PMOS										
NMOS										
CMOS										
LINEAR	147	271	359	566	555	638	714	850	1050	1243
INTERFACE										
CONTROL										
ENTERTAINMENT										
OTHER										
HYBRID										
TOTAL DISCRETE	519	787	876	972	829	841	861	937	1091	1201
TRANSISTOR	311	441	477	498	398	370	375	407	473	514
SMALL SIGNAL	189	293	302	308	242	240	241	258	290	308
POWER	122	148	175	190	156	130	134	149	183	206
DIODE	168	266	279	350	305	317	327	354	407	446
SMALL SIGNAL	71	86	83	94	80	85	86	89	100	105
POWER	79	156	171	225	194	194	202	225	263	294
ZENER	18	24	25	31	31	38	39	40	44	47
THYRISTOR	29	51	73	72	73	101	104	115	137	155
OTHER	11	29	47	52	53	53	55	61	74	86
OPTOELECTRONIC	35	49	80	102	131	156	181	235	303	389
LED LAMPS	5	9	6	11	14	17	19	24	30	37
LED DISPLAYS	16	27	44	49	64	76	89	112	142	174
COUPLERS	3	4	7	11	12	14	16	21	26	32
OTHER	11	9	23	31	41	49	57	78	105	146

Note: Value of Japanese consumption has been translated from yen to dollars at exchange rate applicable during period of estimate. Exchange rates are given in Table A-0 at the end of the Introduction. (See Table A-12 for yen value of Japanese semiconductor consumption.)

Source: Ministry of International Trade and Industry (MITI, Japan)

Appendix A—Market Estimate Worksheets

Table A-4

ESTIMATED EUROPEAN SEMICONDUCTOR CONSUMPTION
(Millions of Dollars)

	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
TOTAL SEMICONDUCTOR	1333	1592	1809	2310	2880	3530	3843	4550	5608	6665
TOTAL I C	561	673	830	1166	1578	2110	2365	2920	3740	4600
BIPOLAR DIGITAL	189	226	259	371	496	620	685	825	1028	1256
TTL										
DTL										
ECL										
OTHER										
MOS	158	216	278	428	612	925	1064	1362	1810	2280
PMOS										
NMOS										
CMOS										
LINEAR	214	231	293	367	470	565	616	733	902	1064
INTERFACE										
CONTROL										
ENTERTAINMENT										
OTHER										
HYBRID										
TOTAL DISCRETE	728	852	897	1029	1147	1225	1257	1354	1524	1659
TRANSISTOR	351	410	448	485	532	570	581	628	695	752
SMALL SIGNAL	243	258	268	282	302	319	320	339	379	399
POWER	108	152	180	203	230	251	261	289	316	353
DIODE	282	309	322	392	450	479	494	525	592	639
SMALL SIGNAL	72	107	108	137	178	185	186	189	207	217
POWER	173	163	180	209	223	237	248	274	317	351
ZENER	37	39	34	46	49	57	60	62	68	71
THYRISTOR	82	99	99	113	121	130	134	148	174	195
OTHER	13	34	28	39	44	46	48	53	63	73
OPTOELECTRONIC	44	67	82	115	155	195	221	276	344	406
LED LAMPS	10	23	32	40	48	60	67	82	98	118
LED DISPLAYS	17	22	32	50	63	79	88	109	136	164
COUPLERS	5	5	7	12	22	27	30	37	46	56
OTHER	12	17	11	13	22	29	36	48	64	68

Note: Please see Introduction to Appendix A for discussion of terms and definitions of forecast.
Exchange rates are given in Table A-0 at the end of the Introduction.
Value of European consumption has been estimated directly in dollars.

Source: DATAQUEST, Inc.

Appendix A—Market Estimate Worksheets

Table A-5

ESTIMATED REST OF WORLD SEMICONDUCTOR CONSUMPTION
(Millions of Dollars)

	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
TOTAL SEMICONDUCTOR	225	333	484	648	883	984	1105	1311	1624	1950
TOTAL I C	90	134	196	302	477	537	617	752	958	1174
BIPOLAR DIGITAL	30	35	51	89	100	127	146	179	226	275
TTL										
DTL										
ECL										
OTHER										
MOS	44	67	88	110	134	150	178	219	289	371
PMOS										
NMOS										
CMOS										
LINEAR	16	32	57	103	243	260	293	354	443	528
INTERFACE										
CONTROL										
ENTERTAINMENT										
OTHER										
HYBRID										
TOTAL DISCRETE	117	171	246	290	324	352	381	423	492	554
TRANSISTOR	62	92	117	123	130	140	156	174	203	229
SMALL SIGNAL	27	44	53	52	42	44	45	49	52	57
POWER	35	48	64	71	88	96	111	125	151	172
DIODE	36	62	86	119	140	157	164	180	206	229
SMALL SIGNAL	16	18	28	30	33	37	38	40	44	47
POWER	18	32	44	66	84	100	105	118	138	156
ZENER	2	12	14	23	23	20	21	22	24	26
THYRISTOR	9	8	23	26	34	38	41	46	55	64
OTHER	10	9	20	22	20	17	20	23	28	32
OPTOELECTRONIC	18	28	42	56	82	95	107	136	174	222
LED LAMPS	4	7	15	18	22	25	28	35	44	54
LED DISPLAYS	9	12	15	18	40	46	51	65	83	103
COUPLERS	1	3	3	8	4	6	7	8	9	11
OTHER	4	6	9	12	16	18	21	28	38	54

Note: Please see Introduction to Appendix A for discussion of terms and definitions of forecast.
Exchange rates are given in Table A-0 at the end of the Introduction.
Value of Rest-of-World consumption has been estimated directly in dollars.

Source: DATAQUEST, Inc.

Appendix A—Market Estimate Worksheets

Table A-6

ESTIMATED WORLDWIDE SEMICONDUCTOR FACTORY SHIPMENTS
(Millions of Dollars)

	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
TOTAL SEMICONDUCTOR	2505	2459	3142	4798	5405	4373	5827	6846	8859	11116
TOTAL I C	801	892	1244	2046	2510	2120	2938	3687	5235	7126
BIPOLAR DIGITAL	412	447	538	921	979	682	905	1084	1405	1799
TTL	169	225	349	658	719	499	711	879	1120	1482
DTL	144	116	98	121	105	81	71	55	53	45
ECL	53	62	58	65	73	55	76	94	140	160
OTHER	46	44	33	77	82	47	47	56	92	112
MOS	97	156	276	585	880	837	1229	1539	2309	3430
PMOS	94	147	260	516	697	609	648	569	595	660
NMOS	0	2	4	13	72	133	377	696	1366	2231
CMOS	3	7	12	56	111	95	204	274	348	539
LINEAR	292	289	430	540	651	601	804	1064	1521	1897
INTERFACE			47	72	91	75	89	95	123	160
CONTROL			190	210	247	243	320	408	537	718
ENTERTAINMENT			99	152	182	165	248	373	580	669
OTHER			94	106	131	118	147	188	281	350
HYBRID										
TOTAL DISCRETE	1656	1515	1791	2586	2700	2028	2601	2850	3205	3395
TRANSISTOR	824	794	935	1377	1400	1063	1343	1447	1557	1581
SMALL SIGNAL	538	497	595	863	874	638	803	811	861	827
POWER	286	297	340	514	526	425	540	636	696	754
DIODE	633	537	640	887	944	709	904	977	1173	1271
SMALL SIGNAL	243	169	205	291	323	211	276	279	316	352
POWER	298	296	346	480	482	398	504	569	682	736
ZENER	92	72	89	116	139	100	124	129	175	183
THYRISTOR	118	107	123	202	232	180	241	295	317	358
OTHER	81	77	93	120	124	76	113	131	158	185
OPTOELECTRONIC	48	52	107	166	195	225	288	309	419	595
LED LAMPS	6	6	15	22	23	32	54	66	89	113
LED DISPLAYS	13	21	55	104	120	128	151	144	193	265
COUPLERS	1	2	7	15	21	22	29	34	51	81
OTHER	28	23	30	25	31	43	54	65	86	136

Note: Please see Introduction to Appendix A for discussion of terms and definitions of forecast.
Exchange rates are given in Table A-0 at the end of the Introduction.

Source: DATAQUEST, Inc.

Appendix A—Market Estimate Worksheets

Table A-7

ESTIMATED NORTH AMERICAN SEMICONDUCTOR FACTORY SHIPMENTS
(Millions of Dollars)

	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
TOTAL SEMICONDUCTOR	1210	1161	1498	2209	2626	2119	2665	3081	3817	5308
TOTAL I C	524	537	749	1192	1499	1216	1612	2027	2681	3895
BIPOLAR DIGITAL	287	263	342	556	595	395	505	621	791	1078
TTL	116	135	224	428	470	303	410	537	680	941
DTL	100	69	63	61	49	43	41	34	33	30
ECL	34	38	36	41	45	33	39	40	57	77
OTHER	37	21	19	26	31	16	15	10	21	30
MOS	75	101	169	383	595	538	791	985	1348	2078
PMOS	72	93	156	323	435	353	327	242	240	276
NMOS	0	2	4	12	66	108	301	525	850	1411
CMOS	3	6	9	48	94	77	163	218	258	391
LINEAR	162	173	238	253	309	283	316	421	542	739
INTERFACE										
CONTROL										
ENTERTAINMENT										
OTHER										
HYBRID										
TOTAL DISCRETE	653	587	678	896	983	751	889	924	975	1160
TRANSISTOR	290	303	358	440	468	368	418	437	495	569
SMALL SIGNAL	175	178	208	230	254	189	225	217	252	287
POWER	115	125	150	210	214	179	193	220	243	282
DIODE	256	189	210	286	327	256	300	322	331	401
SMALL SIGNAL	104	51	47	73	95	62	73	72	47	62
POWER	101	102	119	159	169	142	164	187	193	239
ZENER	51	36	44	54	63	52	63	63	91	100
THYRISTOR	60	54	64	95	102	75	104	113	110	128
OTHER	47	41	46	75	86	52	67	52	39	62
OPTOELECTRONIC	33	37	71	121	144	152	164	130	161	253
LED LAMPS	5	5	9	13	13	15	19	21	25	30
LED DISPLAYS	11	18	46	83	98	98	99	69	80	117
COUPLERS	1	2	5	11	15	14	20	20	28	50
OTHER	16	12	11	14	18	25	26	20	28	56

Note: Please see Introduction to Appendix A for discussion of terms and definitions of forecast.

Source: DATAQUEST, Inc.
Semiconductor Industry Association (SIA)

Appendix A—Market Estimate Worksheets

Table A-8

ESTIMATED JAPANESE SEMICONDUCTOR FACTORY SHIPMENTS
(Millions of Dollars)

	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
TOTAL SEMICONDUCTOR	642	583	826	1322	1199	925	1521	1826	2569	2878
TOTAL I C	141	147	240	432	429	396	665	804	1357	1730
BIPOLAR DIGITAL	59	55	50	95	108	76	106	140	197	231
TTL										
DTL										
ECL										
OTHER										
MOS	17	44	82	163	160	186	290	332	635	887
PMOS	17	43	80	157	146	154	200	180	185	195
NMOS	0	0	0	1	4	19	60	118	395	604
CMOS	0	1	2	5	10	13	30	34	55	88
LINEAR	65	48	108	174	161	134	269	332	525	612
INTERFACE										
CONTROL										
ENTERTAINMENT										
OTHER										
HYBRID										
TOTAL DISCRETE	492	427	563	869	754	507	818	953	1108	999
TRANSISTOR	285	243	312	500	439	305	474	526	559	472
SMALL SIGNAL	189	151	213	362	310	189	302	309	340	261
POWER	96	92	99	138	129	116	172	217	219	211
DIODE	169	152	203	296	248	164	277	313	398	377
SMALL SIGNAL	64	47	68	102	88	58	88	96	120	112
POWER	92	94	120	171	134	88	162	187	235	224
ZENER	13	11	15	23	26	18	27	30	43	41
THYRISTOR	29	23	25	50	46	27	46	70	86	83
OTHER	9	9	23	23	21	11	21	44	65	67
OPTOELECTRONIC	9	9	23	21	16	22	38	69	104	149
LED LAMPS	0	0	2	3	2	3	6	6	13	32
LED DISPLAYS	1	2	7	12	8	10	21	33	53	59
COUPLERS	0	0	1	2	2	3	3	3	8	11
OTHER	8	7	13	4	4	6	8	27	30	47

Note: Please see Introduction to Appendix A for discussion of terms and definitions of forecast.
Exchange rates are given in Table A-0 at the end of the Introduction.
(See Table A-13 for estimated value of Japanese factory shipments expressed in yen.)

Source: DATAQUEST, Inc.
Ministry of International Trade and Industry (MITI, Japan)

Appendix A--Market Estimate Worksheets

Table A-9

ESTIMATED EUROPEAN SEMICONDUCTOR FACTORY SHIPMENTS
(Millions of Dollars)

	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
TOTAL SEMICONDUCTOR	641	698	789	1195	1448	1209	1443	1744	2213	2542
TOTAL I C	136	206	250	403	531	457	556	750	1064	1302
BIPOLAR DIGITAL	66	127	141	252	246	181	227	264	349	393
TTL										
DTL										
ECL										
OTHER										
MOS	5	11	25	39	122	108	142	213	304	416
PMOS	5	11	24	36	113	97	115	138	159	170
NMOS	0	0	0	0	2	6	16	53	113	201
CMOS	0	0	1	3	7	5	11	22	32	45
LINEAR	65	68	84	112	163	168	187	273	411	493
INTERFACE										
CONTROL										
ENTERTAINMENT										
OTHER										
HYBRID										
TOTAL DISCRETE	499	486	527	771	893	717	826	898	1012	1102
TRANSISTOR	241	238	250	396	443	350	395	425	431	448
SMALL SIGNAL	166	158	159	230	260	220	225	232	207	204
POWER	75	80	91	166	183	130	170	193	224	244
DIODE	204	191	219	296	349	276	315	328	413	461
SMALL SIGNAL	71	66	82	107	120	78	103	97	126	160
POWER	105	100	107	150	179	168	178	195	249	263
ZENER	28	25	30	39	50	30	34	36	38	38
THYRISTOR	29	30	34	57	84	78	91	111	118	142
OTHER	25	27	24	22	17	13	25	34	50	51
OPTOELECTRONIC	6	6	12	21	24	35	61	96	137	138
LED LAMPS	1	1	4	6	6	10	23	36	47	41
LED DISPLAYS	1	1	2	7	9	13	20	37	53	53
COUPLERS	0	0	1	2	3	3	4	9	13	17
OTHER	4	4	5	6	6	9	14	14	24	27

Note: Please see Introduction to Appendix A for discussion of terms and definitions of forecast.
Exchange rates are given in Table A-0 at the end of the Introduction.
Value of European factory shipments has been estimated directly in U.S. dollars.

Source: DATAQUEST, Inc.

Table A-10

ESTIMATED REST OF WORLD SEMICONDUCTOR FACTORY SHIPMENTS
(Millions of Dollars)

	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
TOTAL SEMICONDUCTOR	12	17	29	72	132	120	198	195	260	388
TOTAL I C	0	2	5	19	51	51	105	106	133	199
BIPOLAR DIGITAL	0	2	5	18	30	30	67	59	68	97
TTL										
DTL										
ECL										
OTHER										
MOS	0	0	0	0	3	5	6	9	22	49
PMOS	0	0	0	0	3	5	6	9	11	19
NMOS	0	0	0	0	0	0	0	0	8	15
CMOS	0	0	0	0	0	0	0	0	3	15
LINEAR	0	0	0	1	18	16	32	38	43	53
INTERFACE										
CONTROL										
ENTERTAINMENT										
OTHER										
HYBRID										
TOTAL DISCRETE	12	15	23	50	70	53	68	75	110	134
TRANSISTOR	8	10	15	41	50	40	56	59	72	92
SMALL SIGNAL	8	10	15	41	50	40	51	53	62	75
POWER	0	0	0	0	0	0	5	6	10	17
DIODE	4	5	8	9	20	13	12	14	31	32
SMALL SIGNAL	4	5	8	9	20	13	12	14	23	18
POWER	0	0	0	0	0	0	0	0	5	10
ZENER	0	0	0	0	0	0	0	0	3	4
THYRISTOR	0	0	0	0	0	0	0	1	3	5
OTHER	0	0	0	0	0	0	0	1	4	5
OPTOELECTRONIC	0	0	1	3	11	16	25	14	17	55
LED LAMPS	0	0	0	0	2	4	6	3	4	10
LED DISPLAYS	0	0	0	2	5	7	11	5	7	36
COUPLERS	0	0	0	0	1	2	2	2	2	3
OTHER	0	0	1	1	3	3	6	4	4	6

Note: Please see Introduction to Appendix A for discussion of terms and definitions of forecast.
Exchange rates are given in Table A-0 at the end of the Introduction.
Value of Rest-of-World factory shipments has been estimated directly in U.S. dollars.

Source: DATAQUEST, Inc.

Table A-11

ESTIMATED WORLDWIDE SEMICONDUCTOR CONSUMPTION
(Millions of Units)

	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
TOTAL SEMICONDUCTOR	7365	8287	13253	16466	19155	15438	20168	24096	30649	37312	48797	42551	46772	54842	59782
TOTAL IC	541	751	1199	1972	2422	2116	2954	3662	5259	7301	8788	9291	10609	12766	14667
BIPOLAR DIGITAL	354	522	749	1280	1517	1146	1494	1635	2232	3149	3652	3737	4121	4757	5245
TTL	128	295	492	982	1219	962	1261	1400	1986	2844					
ETL	167	166	200	246	171	150	109	71	50	43					
ECL	20	23	23	35	60	55	83	104	121	166					
OTHER	39	38	34	65	67	39	41	60	75	96					
MOS	14	22	46	110	217	304	515	740	1208	1767	2541	3749	3269	4091	4926
PMOS	13	20	42	84	128	152	155	189	310	366					
NMOS	0	1	1	4	15	30	80	156	386	519					
CMOS	1	1	3	22	74	122	280	403	593	902					
LINEAR	173	207	404	534	688	666	945	1279	1819	2405	2595	2805	3239	3918	4516
INTERFACE			30	50	67	61	82	83	115	192					
CONTROL			155	187	246	253	354	492	646	895					
ENTERTAINMENT			112	203	249	220	349	485	719	900					
OTHER			107	94	126	124	160	215	339	458					
HYBRID															
TOTAL DISCRETE	6838	7514	9971	14360	16542	13053	16783	19753	23422	28135	39639	30410	32305	36241	38907
TRANSISTOR	2321	2465	3364	5115	5740	4796	6731	7387	8529	9732	9625	9743	10436	11643	12402
SMALL SIGNAL	2050	2158	2985	4511	5029	4173	5992	6575	7575	8653	8490	8520	9050	10810	10560
POWER	271	307	379	604	711	623	739	812	954	1079	1135	1223	1386	1833	1842
DIODE	4407	4917	6419	8936	10436	7965	9652	11863	14492	17437	18709	19302	20357	22798	24445
SMALL SIGNAL	3188	3528	4128	5740	6748	4737	5275	6926	8332	9468	9458	9525	9750	10780	11225
POWER	1019	1188	1928	2882	3606	2640	3564	4690	5188	6139	7409	7655	8418	9769	10705
ZENER	200	200	371	514	690	588	813	847	972	1618	1858	2122	2189	2389	2511
THYRISTOR	92	94	128	222	269	217	272	321	350	402	478	498	542	645	730
OTHER DISCRETE	18	38	62	87	97	75	128	182	251	564	835	875	970	1155	1330
OPTOELECTRONIC	14	22	82	134	191	261	431	681	1128	1796	2378	2858	3858	5040	6188

Source: DATAQUEST, Inc.

Note: Please see Introduction to Appendix A for discussion of terms and definitions of forecast.

Appendix A—Market Estimate Worksheets

Table A-12

ESTIMATED JAPANESE SEMICONDUCTOR CONSUMPTION
(Billions of Yen)

	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
TOTAL SEMICONDUCTOR	298.5	458.9	487.4	512.1	587.9	688.6	776.0	932.5	1165.1	1355.0
TOTAL IC	134.0	211.2	233.2	290.9	375.3	467.9	545.5	672.9	856.6	1054.9
BIPOLAR DIGITAL	30.0	46.2	50.4	46.7	52.4	58.7	66.8	82.6	103.8	126.4
TTL										
DTL										
ECL										
OTHER										
MOS	60.4	84.7	87.2	127.7	200.1	268.0	320.7	402.2	520.4	653.4
PMOS										
NMOS										
CMOS										
LINEAR	43.6	80.3	95.5	116.5	122.8	141.2	158.0	188.1	232.4	275.1
INTERFACE										
CONTROL										
ENTERTAINMENT										
OTHER										
HYBRID										
TOTAL DISCRETE	154.1	233.1	232.9	200.1	183.5	186.1	190.5	207.5	241.5	265.8
TRANSISTOR	92.3	130.6	126.8	102.5	88.1	81.9	83.0	90.1	104.7	113.8
SMALL SIGNAL	56.1	86.8	80.3	63.4	53.6	53.1	53.3	57.1	64.2	68.2
POWER	36.2	43.8	46.5	39.1	34.5	28.8	29.7	33.0	40.5	45.6
DIODE	49.9	78.8	74.2	72.1	67.5	70.1	72.3	78.4	90.0	98.7
SMALL SIGNAL	21.0	25.5	22.0	19.4	17.7	18.8	19.0	19.7	22.1	23.2
POWER	23.5	46.2	45.5	46.3	42.9	42.9	44.7	49.8	58.2	65.1
ZENER	5.4	7.1	6.7	6.4	6.9	8.4	8.6	8.9	9.7	10.4
THYRISTOR	8.6	15.1	19.4	14.8	16.2	22.4	23.0	25.5	30.3	34.3
OTHER	3.3	8.6	12.5	10.7	11.7	11.7	12.2	13.5	16.4	19.0
OPTOELECTRONIC	10.4	14.6	21.3	21.1	29.1	34.6	40.0	52.1	67.0	86.1
LED LAMPS	1.5	2.7	1.6	2.3	3.1	3.8	4.2	5.3	6.6	8.2
LED DISPLAYS	4.8	8.0	11.7	10.1	14.2	16.8	19.7	24.8	31.4	38.5
COUPLERS	0.9	1.2	1.9	2.3	2.7	3.1	3.5	4.7	5.8	7.1
OTHER	3.3	2.7	6.1	6.4	9.1	10.9	12.6	17.3	23.2	32.3

Source: DATAQUEST, Inc.
Ministry of International Trade and Industry (MITI, Japan)

Table A-13

ESTIMATED JAPANESE SEMICONDUCTOR FACTORY SHIPMENTS
(Yen in Billions)

	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
TOTAL SEMICONDUCTOR	232.7	200.1	246.8	355.2	347.1	276.3	454.1	485.6	529.1	637.1
TOTAL IC	50.5	50.7	72.2	112.3	125.3	117.5	196.9	213.8	279.4	383.0
BIPOLAR DIGITAL	21.1	18.9	15.1	24.6	31.4	22.6	31.5	37.2	40.6	51.1
TTL										
DTL										
ECL										
OTHER										
MOS	6.1	15.1	24.5	42.8	46.7	55.2	85.7	88.3	130.7	196.4
PMOS	6.1	14.8	23.9	41.2	42.6	45.7	59.1	47.9	38.1	43.2
NMOS	0.0	0.0	0.0	0.3	1.2	5.6	17.7	31.4	81.3	133.7
CMOS	0.0	0.3	0.6	1.3	2.9	3.9	8.9	9.0	11.3	19.5
LINEAR	23.3	16.7	32.6	44.9	47.2	39.7	79.7	88.3	108.1	135.5
INTERFACE										
CONTROL										
ENTERTAINMENT										
OTHER										
HYBRID										
TOTAL DISCRETE	179.0	146.3	169.7	227.3	216.6	151.5	242.7	253.4	228.2	221.1
TRANSISTOR	105.0	83.2	94.1	129.2	128.2	90.6	140.3	139.9	115.1	104.5
SMALL SIGNAL	70.7	51.7	64.3	93.1	90.6	56.2	89.4	82.2	70.0	57.8
POWER	34.3	31.5	29.9	37.1	37.6	34.4	50.9	57.7	45.1	46.7
DIODE	60.4	52.1	61.2	79.5	68.9	48.7	82.6	83.2	82.0	83.4
SMALL SIGNAL	22.9	16.1	20.5	27.4	25.7	17.2	26.6	25.5	24.7	24.8
POWER	32.9	32.2	36.2	45.9	35.6	26.1	48.0	49.7	48.4	49.6
ZENER	4.6	3.8	4.5	6.2	7.6	5.4	8.0	8.0	8.9	9.1
THYRISTOR	10.4	7.9	7.5	12.4	13.4	8.0	13.6	18.6	17.7	18.4
OTHER	3.2	3.1	6.9	6.2	6.1	4.2	6.2	11.7	13.4	14.8
OPTOELECTRONIC	3.2	3.1	4.9	5.6	5.2	7.3	14.5	18.4	21.5	33.0
LED LAMPS						0.9	1.8	1.6	2.7	7.1
LED DISPLAYS						2.9	6.2	8.8	10.9	13.1
COUPLERS						0.9	0.9	0.8	1.7	2.4
OTHER						2.6	5.6	7.2	6.2	10.4

Source: DATAQUEST, Inc.
Ministry of International Trade and Industry (MITI, Japan)

Appendix A—Market Estimate Worksheets

INTRODUCTION

Appendix A consists of a set of detailed tables that estimate semiconductor consumption and semiconductor factory shipments both worldwide and for four major geographical regions. Table A-1 details world semiconductor consumption. Tables A-2 through A-5 estimate semiconductor consumption for the four geographical regions—North America, Japan, Western Europe, and the Rest of World (ROW), respectively. Tables A-1 through A-5 also include forecasts for 1981 through 1985. Beginning in 1981, Table A-1 and Table A-6 have additional breakouts under Bipolar Digital and MOS. These new breakouts segment the market by function.

Table A-6 details world factory shipments of semiconductors up to 1980. Tables A-7 through A-10 estimate semiconductor factory shipments in North America, Japan, Western Europe, and the Rest of World. The differences between Tables A-2 through A-5 and Tables A-7 through A-10 for each geographical region, represent the net exports or imports of those regions.

Table A-11 estimates worldwide semiconductor consumption in units to date. Table A-12 gives DATAQUEST forecasts of worldwide semiconductor units consumption through 1985. Table A-13 details the Average Selling Price (ASP) of various semiconductor devices. Tables A-14 and A-15 restate the Japanese tables (A-3 and A-8) in yen.

Each table gives estimates for semiconductor consumption or shipments listed by the major product categories of semiconductor devices. In these tables, semiconductor components are divided into three major product groups: integrated circuits, discrete devices, and optoelectronic devices. These groups are divided into a number of subgroups, some of which are segmented further. The recap boxes in Tables A-1 and A-6 contain the estimates of consumption and factory shipments by function for Bipolar Digital and MOS. Totals for each device group or subgroup are presented at the top of each category. The Bipolar Digital and MOS recap numbers are not included in the totals.

The difference between low-power and high-power transistors is set at the 1-watt power handling capability. Power diodes are rated at 1 amp or higher, while small diodes are rated at less than 1 amp. Special discrete devices that are neither transistors, diodes, nor thyristors are categorized as Other.

DEFINITIONS AND CONVENTIONS

DATAQUEST uses a common manufacturer base for all data tables. This base includes all noncaptive suppliers to the semiconductor market. It excludes captive suppliers that manufacture devices solely for the benefit of the parent company,

such as Burroughs, IBM, NCR, and Western Electric. Included, however, are companies that actively market semiconductor devices to industry as well as to other divisions of their own company. For these companies, both external shipments and internal consumption are included. Devices that are used internally are valued at current market prices.

For purposes of Appendix A, we define consumption as the purchase of a semiconductor device or devices. This definition must be differentiated from actual use of the device in a final product. Devices that are inventoried at the user level are considered consumption according to our definition.

The fabrication and assembly of a semiconductor device may be performed in several different locations. For the purposes of Appendix A, factory shipments are defined geographically as occurring from that point where the device was tested and marked, irrespective of where the device was assembled or where the initial wafer fabrication was performed.

In earlier Appendix A editions, hybrid devices were included as a separate segment of integrated circuits. However, since hybrid devices are primarily a special packaging arrangement, this segment has been omitted. Hybrid devices manufactured by semiconductor companies are now included in the most appropriate product segment.

The detailed definitions of manufacturer base we have used in our tables may differ from those used in other studies of this type. Our base is nearly the same as that used by the Semiconductor Industry Association (SIA), but is different from that used by many companies, and certain assumptions or conventions implicit in our forecast may differ from the forecasts of others.

North America is defined as including both the United States and Canada. Latin America, including Mexico, is considered part of the ROW category.

DATA SOURCES

No single official source of information on worldwide production and trade in semiconductors exists. The information presented in Appendix A is a consolidation from a wide variety of fragmentary sources, each of which focuses on a specific part of the market.

- U.S. data prior to 1973 rely to a large degree on data collected by the Electronics Industry Association (EIA). More recent data are compiled from a variety of published and nonpublished sources.
- In Japan, statistics are compiled and published by the Ministry of International Trade and Industry (MITI).

Appendix A—Market Estimate Worksheets

- For West European markets, U.S. Department of Commerce trade statistics, marketing statistics from the Semiconductor Industry Association (SIA), and shipment estimates for each company are the primary data sources used.

- U.S. Commerce Department trade statistics and MITI trade statistics constitute the major published sources used to estimate ROW consumption and factory shipments.

The broad scope and detailed breakdown of these tables indicate the major effort that was expended in developing production data. We believe that the estimates presented are the most accurate and meaningful generally available today. The sources of the data presented in the tables are:

- Unit sales or revenues (or both) published by major industry participants, both in the United States and abroad

- Estimates presented by knowledgeable and reliable industry spokesmen

- Government data or trade association data such as that from EIA, MITI, SIA, and the U.S. Department of Commerce

- Published product literature and price lists

- Interviews with knowledgeable manufacturers, distributors, and users

- Relevant projected world economic data

CONSISTENCY

One of the key objectives in preparing these estimates is to achieve consistency among the various data elements that constitute the forecast and the past data base. To ensure the accuracy and consistency of the estimates, we compared the value of directly obtained data elements with values obtained by indirect means, wherever possible. Thus, the data in Appendix A are consistent with Market Share estimates in Appendix B and with the individual company revenue breakdowns in the companies section, as well as with summary tables presented in Chapter 2, "Semiconductor Markets."

Appendix A—Market Estimate Worksheets

ACCURACY

The tables presented here represent DATAQUEST estimates that we believe are reasonably accurate. Where we have no reasonable estimate, none is given. A blank space in a table indicates that a reasonably accurate estimate is unavailable, and a zero in a table represents an estimate.

VALUATION OF CONSUMPTION AND FACTORY SHIPMENTS

Regional consumption and factory shipment amounts are expressed in U.S. dollars. To make the tables of Appendix A useful in comparing different regions, it is necessary to express all values in a common currency and, because of the U.S. producers' large presence in international markets, the dollar is the preferred choice.

However, the choice of the U.S. dollar (or any single currency, for that matter) as the currency basis for the tables, brings with it some problems that require the readers' careful consideration in interpreting the data.

Inflation

All countries that participate significantly in international semiconductor markets suffered from an overall price inflation in the 1970s.

As a consequence, the dollar in a given year is not truly comparable with the dollar in any preceding year. Consumer and Wholesale Price Indices and GNP Deflators all measure price changes in various composite "market baskets" of goods. However, there is no price index that measures price changes of material and labor inputs to the semiconductor industry. Indeed, the "mix" is changing so rapidly that what is used this year was sometimes unavailable last year, at any price. Nor is there a composite price index that measures price changes in aggregate semiconductor product. In an industry noted for its inflationary trends, this latter effect would tend to make the component purchaser's dollar worth more as time passed in terms of purchasing electronic capability.

We have made no adjustments in the historical data to account for these inflationary and deflationary effects. The data are expressed in current dollars for all historical data, and comparisons between different years must be interpreted accordingly.

Appendix A—Market Estimate Worksheets

Exchange Rates

Construction of the tables requires combining data from many countries, each of which has different and changing exchange rates. This situation raises a related issue of how to express foreign production in terms of current U.S. dollars.

Because approximately 50 percent of Western Europe's consumption is produced by U.S. companies, DATAQUEST estimates of the overall West European market have always been made directly in dollars. The exchange rates for major currencies can be found in Table A-0 at the end of this introduction.

Japanese consumption and factory shipments are based on MITI data, which are originally expressed in yen. The yen/dollar exchange rate for each year can be found in Table A-0. Tables A-3 and A-8 give Japanese consumption and factory shipments in dollars for the appropriate exchange rate for each year. Tables A-14 and A-15 give the same information expressed in yen. Because of the fluctuations in the exchange rate, the dollar values given tend to distort the growth rate of the Japanese market, but they do provide a useful basis for regional comparisons. The data in yen give a better picture of the real growth in the Japanese market.

FORECAST

As mentioned previously, historical data are expressed in current dollars. For the consumption forecast, which appears in Tables A-1 through A-5, all estimates for 1980 and beyond are made as if 1980 monetary conditions will continue through 1985; i.e., zero inflation and unchanging exchange rates. Therefore, the forecast is in 1980 constant-value dollars at 1980 exchange rates.

Information on interregional trade and other analyses used in the preparation of these tables is available to DATAQUEST clients upon request.

Frederick L. Zieber
Jean Page
Katy Guill

Appendix A—Market Estimate Worksheets

Table A-0

ANNUAL FOREIGN EXCHANGE RATES
(Expressed in U.S. Dollars)

Year	Japan: Dollars Per Yen	France: Dollars Per French Franc	West Germany: Dollars Per Deutsch Mark	United Kingdom: Dollars Per Pound Sterling
1970	$0.002795	$0.1810	$0.2744	$2.3963
1971	$0.002913	$0.1822	$0.2886	$2.4506
1972	$0.003311	$0.1985	$0.3140	$2.4878
1973	$0.003721	$0.2267	$0.3811	$2.4587
1974	$0.003427	$0.2099	$0.3897	$2.3524
1975	$0.003368	$0.2337	$0.4063	$2.2069
1976	$0.003376	$0.2091	$0.3998	$1.7960
1977	$0.003761	$0.2042	$0.4337	$1.7602
1978	$0.004857	$0.2251	$0.5051	$2.0260
1979	$0.004518	$0.2361	$0.5482	$2.1312
1980	$0.004449	$0.2335	$0.5463	$2.3241
January-March average, 1981	$0.004800	$0.2025	$0.4736	$2.2795

Source: Federal Reserve Bulletin
DATAQUEST, Inc.

1981

Appendix A—Market Estimate Worksheets

Table A-1

ESTIMATED WORLDWIDE SEMICONDUCTOR CONSUMPTION
(Millions of Dollars)

	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
TOTAL SEMICONDUCTOR	5827	6846	8859	11116	14119	13763	15913	19588	23978	29093
Total Integrated Circuit	2941	3687	5235	7126	9772	9552	11232	14121	17607	21701
Bipolar Digital	865	1026	1315	1703	2450	2499	2890	3562	4304	5200
TTL	682	830	1041	1410	2117					
DTL	71	56	56	48	45					
ECL	76	94	140	157	189					
Other	36	46	78	88	99					
Bipolar Digital (RECAP)	865	1026	1315	1703	2450	2499	2890	3562	4304	5200
Memory				327	553					
Logic				1376	1897					
MOS	1239	1564	2369	3480	4921	4735	5713	7354	9412	11799
NMOS				2346	518					
PMOS				517	3455					
CMOS				617	948					
MOS (RECAP)	1239	1564	2369	3480	4921	4735	5713	7354	9412	11799
Memory				1705	2514					
Microprocessor				543	799					
Logic				1232	1608					
Linear	837	1097	1551	1943	2401	2318	2629	3205	3891	4702
Total Discrete	2598	2850	3205	3395	3648	3537	3896	4488	5172	5922
Transistor	1333	1437	1547	1571	1655	1646	1800	2071	2363	2689
Small Signal	793	801	851	817	849	851	900	1007	1118	1243
Power Transistor	540	636	696	754	806	795	900	1064	1245	1446
Diode	911	997	1193	1291	1427	1334	1475	1695	1973	2265
Small Signal	286	309	366	407	443	362	388	434	521	584
Power	504	559	662	711	790	785	884	1030	1193	1384
Zener	121	129	165	173	194	187	203	231	259	297
Thyristor	241	295	317	358	390	369	412	479	559	645
Other	113	121	148	175	176	188	209	243	277	323
Total Optoelectronic	288	309	419	595	699	674	785	979	1199	1470
LED Lamps	54	66	89	113	130	128	142	173	207	245
LED Displays	151	144	193	265	294	278	329	414	508	627
Optical Couplers	29	34	51	81	103	104	119	142	170	208
Other	54	65	86	136	172	164	195	250	314	390

Note: Please see Introduction to Appendix A for discussion of terms and definitions of forecast. Exchange rates are given in Table A-0 at the end of the Introduction.

Source: DATAQUEST, Inc.
August, 1981

Appendix A—Market Estimate Worksheets

Table A-2

ESTIMATED NORTH AMERICAN SEMICONDUCTOR CONSUMPTION
(Millions of Dollars)

	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
TOTAL SEMICONDUCTOR	2351	2720	3414	4677	6039	5902	7055	8748	10685	12851
Total Integrated Circuit	1418	1784	2354	3375	4721	4604	5574	7019	8693	10585
Bipolar Digital	488	584	718	981	1419	1413	1662	2036	2432	2908
TTL										
DTL										
ECL										
Other										
MOS	660	845	1151	1765	2521	2413	3017	3889	4954	6118
NMOS										
PMOS										
CMOS										
Linear	270	355	485	629	781	778	895	1094	1307	1559
Total Discrete	789	831	914	1075	1078	1065	1201	1382	1566	1748
Transistor	400	405	451	521	513	508	567	649	733	809
Small Signal	208	194	219	241	231	221	240	269	296	320
Power Transistor	192	211	232	280	282	287	327	380	437	489
Diode	265	290	312	376	391	384	435	504	569	638
Small Signal	65	60	55	61	63	61	67	76	84	92
Power	153	174	182	235	246	243	279	324	369	418
Zener	47	56	75	80	82	80	89	104	116	128
Thyristor	83	100	106	130	128	125	144	166	193	220
Other	41	36	45	48	46	48	55	63	71	81
Total Optoelectronic	144	105	146	227	240	233	280	347	426	518
LED Lamps	15	13	20	29	30	30	34	41	46	53
LED Displays	90	53	76	98	96	88	106	131	160	193
Optical Couplers	17	17	20	43	54	55	65	79	97	118
Other	22	22	30	57	60	60	75	96	123	154

Note: Please see Introduction to Appendix A for discussion of terms and definitions of forecast.

Source DATAQUEST, Inc.
U.S. Department of Commerce, Bureau of the Census
Semiconductor Industry Association (SIA)

Appendix A—Market Estimate Worksheets

Table A-3

ESTIMATED JAPANESE SEMICONDUCTOR CONSUMPTION
(Millions of Dollars)

	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
TOTAL SEMICONDUCTOR	1549	1833	2487	2671	3438	3574	4040	4963	6114	7475
Total Integrated Circuit	713	877	1413	1711	2269	2351	2688	3384	4253	5300
Bipolar Digital	156	190	227	237	413	441	501	616	764	934
TTL										
DTL										
ECL										
Other										
MOS	286	328	620	904	1119	1169	1352	1747	2249	2866
NMOS										
PMOS										
CMOS										
Linear	271	359	566	570	737	741	835	1021	1240	1500
Total Discrete	787	876	972	829	983	1027	1132	1298	1513	1741
Transistor	441	477	498	398	465	482	527	605	682	780
Small Signal	293	302	308	242	275	280	299	332	365	406
Power Transistor	148	175	190	156	190	202	228	273	317	374
Diode	266	279	350	305	363	381	423	480	585	675
Small Signal	86	83	94	80	107	114	124	138	193	216
Power	156	171	225	194	216	225	254	291	334	388
Zener	24	25	31	31	40	42	45	51	58	71
Thyristor	51	73	72	73	94	99	110	129	149	172
Other	29	47	52	53	61	65	72	84	97	114
Total Optoelectronic	49	80	102	131	186	196	220	281	348	434
LED Lamps	9	6	11	14	30	32	35	44	53	62
LED Displays	27	44	49	64	83	88	99	128	159	200
Optical Couplers	4	7	11	12	16	17	19	23	26	31
Other	9	23	31	41	57	59	67	86	110	141

Note: Value of Japanese consumption has been translated from yen to dollars at exchange rate applicable during period of estimate.
Exchange rates are given in Table A-0 at the end of the Introduction. (See Table A-14 for yen value of Japanese semiconductor consumption.)

Source: Ministry of International Trade and Industry (MITI, Japan)

Appendix A—Market Estimate Worksheets

Table A-4

ESTIMATED WESTERN EUROPEAN SEMICONDUCTOR CONSUMPTION
(Millions of Dollars)

	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
TOTAL SEMICONDUCTOR	1594	1821	2354	2970	3670	3337	3716	4490	5462	6644
Total Integrated Circuit	676	842	1210	1648	2317	2144	2429	3015	3755	4666
Bipolar Digital	186	213	325	420	537	562	629	784	947	1159
TTL										
DTL										
ECL										
Other										
MOS	226	303	488	677	1104	986	1139	1443	1845	2339
NMOS										
PMOS										
CMOS										
Linear	264	326	397	551	676	596	661	788	963	1168
Total Discrete	851	897	1029	1167	1192	1055	1129	1287	1482	1702
Transistor	400	438	475	522	511	492	523	596	689	791
Small Signal	248	252	272	292	275	286	291	324	366	413
Power Transistor	152	186	203	230	236	206	232	272	323	378
Diode	318	342	412	470	503	404	433	494	565	648
Small Signal	117	138	187	233	225	143	149	165	182	205
Power	163	170	189	198	231	221	242	285	334	387
Zener	38	34	36	39	47	40	42	44	49	56
Thyristor	99	99	113	121	133	109	118	134	158	182
Other	34	18	29	54	45	50	55	63	70	81
Total Optoelectronic	67	82	115	155	161	138	158	188	225	276
LED Lamps	23	32	40	48	41	38	40	47	55	66
LED Displays	22	32	50	63	58	51	62	75	92	115
Optical Couplers	5	7	12	22	27	25	27	30	35	44
Other	17	11	13	22	35	24	29	36	43	51

Note: Please see Introduction to Appendix A for discussion of terms and definitions of forcast.
Exchange rates are given in Table A-0 at the end of the Introduction.
Value of Western European factory shipments has been estimated directly in U.S. Dollars.

Source: DATAQUEST, Inc.
August, 1981

Appendix A—Market Estimate Worksheets

Table A-5

ESTIMATED REST OF WORLD SEMICONDUCTOR CONSUMPTION
(Millions of Dollars)

	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
TOTAL SEMICONDUCTOR	333	472	604	798	972	950	1102	1387	1717	2123
Total Integrated Circuit	134	184	258	392	465	453	541	703	906	1150
Bipolar Digital	35	39	45	65	81	83	98	126	161	199
TTL										
DTL										
ECL										
Other										
MOS	67	88	110	134	177	167	205	275	364	476
NMOS										
PMOS										
CMOS										
Linear	32	57	103	193	207	203	238	302	381	475
Total Discrete	171	246	290	324	395	390	434	521	611	731
Transistor	92	117	123	130	166	164	183	221	259	309
Small Signal	44	53	52	42	68	64	70	82	91	104
Power Transistor	48	64	71	88	98	100	113	139	168	205
Diode	62	86	119	140	170	165	184	217	254	304
Small Signal	18	28	30	33	48	44	48	55	62	71
Power	32	44	66	84	97	96	109	130	156	191
Zener	12	14	23	23	25	25	27	32	36	42
Thyristor	8	23	26	34	35	36	40	50	59	71
Other	9	20	22	20	24	25	27	33	39	47
Total Optoelectronic	28	42	56	82	112	107	127	163	200	242
LED Lamps	7	15	18	22	29	28	33	41	53	64
LED Displays	12	15	18	40	57	51	62	80	97	119
Optical Couplers	3	3	8	4	6	7	8	10	12	15
Other	6	9	12	16	20	21	24	32	38	44

Note: Please see Introduction to Appendix A for discussion of terms and definitions of forecast.
Exchange rates are given in Table A-0 at the end of the Introduction.
Value of Rest-of-World Consumption has been estimated directly in dollars.

Source: DATAQUEST, Inc.
August, 1981

Appendix A—Market Estimate Worksheets

Table A-6

ESTIMATED WORLDWIDE SEMICONDUCTOR FACTORY SHIPMENTS
(Millions of Dollars)

	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
TOTAL SEMICONDUCTOR	2459	3142	4798	5405	4373	5827	6846	8859	11116	14119
Total Integrated Circuit	892	1244	2046	2510	2120	2941	3687	5235	7126	9772
Bipolar Digital	447	526	890	944	663	865	1026	1315	1703	2450
TTL		341	633	695	484	682	830	1041	1410	2117
DTL		98	115	103	83	71	56	56	48	45
ECL		55	64	72	58	76	94	140	157	189
Other		32	78	74	38	36	46	78	88	99
Bipolar Digital (RECAP)	447	526	890	944	663	865	1026	1315	1703	2450
Memory									327	553
Logic									1376	1897
MOS	156	278	591	890	847	1239	1564	2369	3480	4921
NMOS	2	4	13	72	133	377	696	1366	2216	991
PMOS	147	262	522	707	619	658	594	635	675	120
CMOS	7	12	56	111	95	204	274	368	589	280
MOS (RECAP)	156	278	591	890	847	1239	1564	2369	3480	4921
Memory									1705	2514
Microprocessor									543	799
Logic									1232	1608
Linear	289	440	565	676	610	837	1097	1551	1943	2401
Total Discrete	1515	1791	2586	2700	2028	2598	2850	3205	3395	3648
Transistor	794	935	1377	1400	1063	1333	1437	1547	1571	1655
Small Signal	497	595	863	874	638	793	801	851	817	849
Power Transistor	297	340	514	526	425	540	636	696	754	806
Diode	537	640	887	944	709	911	997	1193	1291	1427
Small Signal	169	205	291	323	211	286	309	366	407	443
Power	296	346	480	482	398	504	559	662	711	790
Zener	72	89	116	139	100	121	129	165	173	194
Thyristor	107	123	202	232	180	241	295	317	358	390
Other	77	93	120	124	76	113	121	148	175	176
Total Optoelectronic	52	107	166	195	225	288	309	419	595	699
LED Lamps	6	15	22	23	32	54	66	89	113	130
LED Displays	21	55	104	120	128	151	144	193	265	294
Optical Couplers	2	7	15	21	22	29	34	51	81	103
Other	23	30	25	31	43	54	65	86	136	172

Note: Please see Introduction to Appendix A for discussion of terms and definitions of forecast. Exchange rates are given in Table A-0 at the end of the Introduction.

Source: DATAQUEST, Inc.
August, 1981

Appendix A—Market Estimate Worksheets

Table A-7

ESTIMATED NORTH AMERICAN SEMICONDUCTOR FACTORY SHIPMENTS
(Millions of Dollars)

	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
TOTAL SEMICONDUCTOR	1161	1498	2209	2626	2119	2665	3081	3817	5288	6593
Total Integrated Circuit	537	749	1192	1499	1216	1612	2027	2681	3895	5118
Bipolar Digital	263	342	556	595	395	505	621	791	1093	1500
TTL	135	224	428	470	303	410	537	680	955	1336
DTL	69	63	61	49	43	41	34	33	30	21
ECL	38	36	41	45	33	39	40	57	77	98
Other	21	19	26	31	16	15	10	21	31	45
MOS	101	169	383	595	538	791	985	1348	2063	2689
NMOS	2	4	12	66	108	301	525	900	1486	1948
PMOS	93	156	323	435	353	327	242	190	186	198
CMOS	6	9	48	94	77	163	218	258	391	543
Linear	173	238	253	309	283	316	421	542	739	929
Total Discrete	587	678	896	983	751	889	924	975	1140	1220
Transistor	303	358	440	468	368	418	437	495	569	577
Small Signal	178	208	230	254	189	225	217	252	287	289
Power Transistor	125	150	210	214	179	193	220	243	282	288
Diode	189	210	286	327	256	300	322	331	401	458
Small Signal	51	47	73	95	62	73	72	47	62	60
Power	102	119	159	169	142	164	187	193	239	285
Zener	36	44	54	63	52	63	63	91	100	113
Thyristor	54	64	95	102	75	104	113	110	128	140
Other	41	46	75	86	52	67	52	39	42	45
Total Optoelectronic	37	71	121	144	152	164	130	161	253	255
LED Lamps	5	9	13	13	15	19	21	25	30	27
LED Displays	18	46	83	98	98	99	69	80	117	110
Optical Couplers	2	5	11	15	14	20	20	28	50	60
Other	12	11	14	18	25	26	20	28	56	58

Note: Please see Introduction to Appendix A for discussion of terms and definitions of forecast.

Source: DATAQUEST, Inc.
Semiconductor Industry Association (SIA)

Appendix A—Market Estimate Worksheets

Table A-8

ESTIMATED JAPANESE SEMICONDUCTOR FACTORY SHIPMENTS
(Millions of Dollars)

	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
TOTAL SEMICONDUCTOR	583	826	1322	1199	925	1521	1826	2569	2878	3840
Total Integrated Circuit	147	240	432	429	396	665	804	1357	1730	2534
Bipolar Digital	55	50	95	108	76	106	140	197	231	323
TTL										
DTL										
ECL										
Other										
MOS	44	82	163	160	186	290	332	635	887	1391
NMOS	0	0	1	4	19	60	118	365	566	961
PMOS	43	80	157	146	154	200	180	165	155	150
CMOS	1	2	5	10	13	30	34	105	166	280
Linear	48	108	174	161	134	269	332	525	612	820
Total Discrete	427	563	869	754	507	818	953	1108	999	1097
Transistor	243	312	500	439	305	474	526	559	472	506
Small Signal	151	213	362	310	189	302	309	340	261	268
Power Transistor	92	99	138	129	116	172	217	219	211	238
Diode	152	203	296	248	164	277	313	398	377	425
Small Signal	47	68	102	88	58	88	96	120	112	138
Power	94	120	171	134	88	162	187	235	224	245
Zener	11	15	23	26	18	27	30	43	41	42
Thyristor	23	25	50	46	27	46	70	86	83	93
Other	9	23	23	21	11	21	44	65	67	73
Total Optoelectronic	9	23	21	16	22	38	69	104	149	209
LED Lamps	0	2	3	2	3	6	6	13	32	61
LED Displays	2	7	12	8	10	21	33	53	59	81
Optical Couplers	0	1	2	2	3	3	3	8	11	14
Other	7	13	4	4	6	8	27	30	47	53

Note: Please see Introduction to Appendix A for discussion of terms and definitions of forecast. Exchange rates are given in Table A-0 at the end of the Introduction.(See Table A-15 for estimated value of Japanese factory shipments expressed in yen.)

Source: Ministry of International Trade and Industry (MITI, Japan)

Appendix A—Market Estimate Worksheets

Table A-9

ESTIMATED WESTERN EUROPEAN SEMICONDUCTOR FACTORY SHIPMENTS
(Millions of Dollars)

	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
TOTAL SEMICONDUCTOR	698	789	1195	1448	1209	1443	1744	2213	2562	3190
Total Integrated Circuit	206	250	403	531	457	559	750	1064	1302	1866
Bipolar Digital	127	129	221	211	162	187	206	259	282	509
TTL										
DTL										
ECL										
Other										
MOS	11	27	45	132	118	152	238	364	481	770
NMOS	0	0	0	2	6	16	53	153	279	525
PMOS	11	26	42	123	107	125	163	179	157	155
CMOS	0	1	3	7	5	11	22	32	45	90
Linear	68	94	137	188	177	220	306	441	539	587
Total Discrete	486	527	771	893	717	823	898	1012	1122	1167
Transistor	238	250	396	443	350	385	415	421	438	462
Small Signal	158	159	230	260	220	215	222	197	194	208
Power Transistor	80	91	166	183	130	170	193	224	244	254
Diode	191	219	296	349	276	322	348	433	481	501
Small Signal	66	82	107	120	78	113	127	176	215	222
Power	100	107	150	179	168	178	185	229	238	246
Zener	25	30	39	50	30	31	36	28	28	33
Thyristor	30	34	57	84	78	91	111	118	142	151
Other	27	24	22	17	13	25	24	40	61	53
Total Optoelectronic	6	12	21	24	35	61	96	137	138	157
LED Lamps	1	4	6	6	10	23	36	47	41	32
LED Displays	1	2	7	9	13	20	37	53	53	54
Optical Couplers	0	1	2	3	3	4	9	13	17	25
Other	4	5	6	6	9	14	14	24	27	46

Note: Please see Introduction to Appendix A for discussion of terms and definitions of forcast.
Exchange rates are given in Table A-0 at the end of the Introduction.
Value of Western European factory shipments has been estimated directly in U.S. Dollars.

Source: DATAQUEST, Inc.
August, 1981

Appendix A—Market Estimate Worksheets

Table A-10

ESTIMATED REST OF WORLD SEMICONDUCTOR FACTORY SHIPMENTS
(Millions of Dollars)

	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
TOTAL SEMICONDUCTOR	17	29	72	132	120	198	195	260	388	496
Total Integrated Circuit	2	5	19	51	51	105	106	133	199	254
Bipolar Digital	2	5	18	30	30	67	59	68	97	118
TTL										
DTL										
ECL										
Other										
MOS	0	0	0	3	5	6	9	22	49	71
NMOS	0	0	0	0	0	0	0	8	15	21
PMOS	0	0	0	3	5	6	9	11	19	15
CMOS	0	0	0	0	0	0	0	3	15	35
Linear	0	0	1	18	16	32	38	43	53	65
Total Discrete	15	23	50	70	53	68	75	110	134	164
Transistor	10	15	41	50	40	56	59	72	92	110
Small Signal	10	15	41	50	40	51	53	62	75	84
Power Transistor	0	0	0	0	0	5	6	10	17	26
Diode	5	8	9	20	13	12	14	31	32	43
Small Signal	5	8	9	20	13	12	14	23	18	23
Power	0	0	0	0	0	0	0	5	10	14
Zener	0	0	0	0	0	0	0	3	4	6
Thyristor	0	0	0	0	0	0	1	3	5	6
Other	0	0	0	0	0	0	1	4	5	5
Total Optoelectronic	0	1	3	11	16	25	14	17	55	78
LED Lamps	0	0	0	2	4	6	3	4	10	10
LED Displays	0	0	2	5	7	11	5	7	36	49
Optical Couplers	0	0	0	1	2	2	2	2	3	4
Other	0	1	1	3	3	6	4	4	6	15

Note: Please see Introduction to Appendix A for discussion of terms and definitions of forecast.
Exchange rates are given in Table A-0 at the end of the Introduction.
Value of Rest-of-World factory shipments has been estimated directly in U.S. Dollars.

Source: DATAQUEST, Inc.
August, 1981

Appendix A—Market Estimate Worksheets

Table A-11

ESTIMATED WORLDWIDE SEMICONDUCTOR CONSUMPTION
(Millions of Units)

	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
TOTAL SEMICONDUCTOR	8287	11254	16412	19155	15430	20168	24096	30009	37312	44524
Total Integrated Circuit	751	1199	1918	2422	2116	2954	3662	5259	7381	9027
Bipolar Digital	522	749	1274	1517	1146	1494	1635	2232	3149	3508
TTL	295	492	928	1219	902	1261	1400	1986	2844	
DTL	166	200	246	171	150	109	71	50	43	
ECL	23	23	35	60	55	83	104	121	166	
Other	38	34	65	67	39	41	60	75	96	
MOS	22	46	110	217	304	515	748	1208	1787	2630
NMOS	1	1	4	15	30	80	156	306	519	
PMOS	20	42	84	128	152	155	189	310	366	
CMOS	1	3	22	74	122	280	403	592	902	
Linear	207	404	534	688	666	945	1279	1819	2445	2889
Total Discrete	7514	9973	14360	16542	13053	16783	19753	23622	28135	33223
Transistor	2465	3364	5115	5740	4796	6731	7387	8529	9732	11003
Small Signal	2158	2985	4511	5029	4173	5992	6575	7575	8653	9603
Power Transistor	307	379	604	711	623	739	812	954	1079	1400
Diode	4917	6419	8936	10436	7965	9652	11863	14492	17437	20895
Small Signal	3520	4120	5740	6740	4737	5275	6926	8332	9680	12614
Power	1188	1928	2682	3006	2640	3564	4090	5188	6139	6888
Zener	209	371	514	690	588	813	847	972	1618	1393
Thyristor	94	128	222	269	217	272	321	350	402	399
Other	38	62	87	97	75	128	182	251	564	926
Total Optoelectronic	22	82	134	191	261	431	681	1128	1796	2274

Note: Please see Introduction to Appendix A for discussion of terms and definitions of forecast.

Source: DATAQUEST, Inc.
August, 1981

Appendix A—Market Estimate Worksheets

Table A-12

ESTIMATED WORLDWIDE SEMICONDUCTOR CONSUMPTION FORECAST
(Millions of Units)

	1980	1981	1982	1983	1984	1985
TOTAL SEMICONDUCTOR	44524	43309	49102	58130	69662	82474
Total Integrated Circuit	9027	8770	10149	12069	14533	17483
Bipolar Digital	3508	3332	3959	4567	5186	5977
TTL						
DTL						
ECL						
Other						
MOS	2630	2645	3023	3641	4659	5841
NMOS						
PMOS						
CMOS						
Linear	2889	2793	3167	3861	4688	5665
Total Discrete	33223	32132	35934	42145	50333	59111
Transistor	11003	11631	13087	15563	18423	21806
Small Signal	9603	10131	11250	13250	15528	18279
Power Transistor	1400	1500	1837	2313	2895	3527
Diode	20895	19164	21386	24904	30005	35105
Small Signal	12614	10343	11086	12400	14886	16686
Power	6888	7476	8840	10842	13256	16282
Zener	1393	1345	1460	1662	1863	2137
Thyristor	399	348	361	399	447	500
Other	926	989	1100	1279	1458	1700
Total Optoelectronic	2274	2407	3019	3916	4796	5880

Note: Please see Introduction to Appendix A for discussion of terms and definitions of forecast.

Source: DATAQUEST, Inc.
August, 1981

Appendix A—Market Estimate Worksheets

Table A-13

ESTIMATED AVERAGE SELLING PRICES
(Dollars)

	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
TOTAL SEMICONDUCTOR	0.30	0.28	0.29	0.28	0.28	0.29	0.28	0.30	0.30	0.32
Total Integrated Circuit	1.19	1.04	1.04	1.04	1.00	0.99	1.01	1.00	0.97	1.08
Bipolar Digital	0.86	0.72	0.69	0.65	0.60	0.61	0.66	0.63	0.57	0.70
TTL	0.76	0.71	0.67	0.59	0.55	0.56	0.63	0.56	0.52	
DTL	0.70	0.49	0.49	0.61	0.54	0.65	0.77	1.06	1.05	
ECL	2.70	2.52	1.86	1.22	1.00	0.92	0.90	1.16	0.96	
Other	1.16	0.97	1.18	1.22	1.21	1.15	0.93	1.23	1.17	
MOS	7.09	6.00	5.32	4.06	2.75	2.39	2.06	1.91	1.92	1.87
NMOS				4.80	4.43	4.71	4.46	4.46	4.30	
PMOS	7.35	6.19	6.14	5.45	4.01	4.18	3.01	1.92	1.80	
CMOS	7.00	4.00	2.55	1.50	0.78	0.73	0.68	0.59	0.60	
Linear	1.40	1.06	1.01	0.95	0.90	0.85	0.83	0.84	0.78	0.83
Control		1.23	1.12	1.00	0.92	0.90	0.83	0.83	0.80	
Interface		1.57	1.44	1.36	1.23	1.09	1.09	1.07	0.83	
Special Consumer		0.88	0.75	0.73	0.72	0.71	0.77	0.81	0.74	
Other		0.88	1.13	1.04	0.95	0.92	0.87	0.83	0.76	
Total Discrete	0.20	0.18	0.18	0.16	0.16	0.15	0.14	0.14	0.12	0.11
Transistor	0.32	0.28	0.27	0.24	0.22	0.20	0.20	0.18	0.16	0.15
Small Signal	0.23	0.20	0.19	0.17	0.15	0.13	0.12	0.11	0.10	0.09
Power Transistor	0.97	0.90	0.85	0.74	0.68	0.73	0.78	0.73	0.70	0.58
Diode	0.11	0.10	0.10	0.09	0.09	0.09	0.08	0.08	0.07	0.07
Small Signal	0.08	0.07	0.06	0.06	0.05	0.05	0.04	0.04	0.04	0.04
Power	0.25	0.18	0.18	0.16	0.15	0.14	0.14	0.13	0.12	0.11
Zener	0.34	0.24	0.23	0.20	0.17	0.15	0.15	0.18	0.11	0.14
Thyristor	1.14	0.96	0.91	0.86	0.83	0.89	0.92	0.91	0.89	0.98
Other	2.03	1.50	1.38	1.28	1.01	0.88	0.72	0.63	0.33	0.19
Total Optoelectronic	2.36	1.30	1.24	1.02	0.86	0.67	0.45	0.37	0.33	0.31

Source: DATAQUEST, Inc.
August, 1981

Appendix A—Market Estimate Worksheets

Table A-14

ESTIMATED JAPANESE SEMICONDUCTOR CONSUMPTION
(Billions of Yen)

	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
TOTAL SEMICONDUCTOR	458.9	487.3	512.1	587.9	772.8	803.3	908.2	1115.7	1374.1	1680.3
Total Integrated Circuit	211.2	233.1	290.9	375.3	510.0	528.5	604.2	760.7	955.9	1191.3
Bipolar Digital	46.2	50.4	46.7	52.4	92.8	99.1	112.6	138.5	171.7	209.9
TTL										
DTL										
ECL										
Other										
MOS	84.7	87.2	127.7	200.1	251.5	262.8	303.9	392.7	505.5	644.2
NMOS										
PMOS										
CMOS										
Linear	80.3	95.5	116.5	122.8	165.7	166.6	187.7	229.5	278.7	337.2
Total Discrete	233.1	232.9	200.1	183.5	221.0	230.8	254.5	291.8	340.1	391.4
Transistor	130.6	126.8	102.5	88.1	104.5	108.3	118.5	136.0	153.3	175.3
Small Signal	86.8	80.3	63.4	53.6	61.8	62.9	67.2	74.6	82.0	91.2
Power Transistor	43.8	46.5	39.1	34.5	42.7	45.4	51.3	61.4	71.3	84.1
Diode	78.8	74.2	72.1	67.5	81.7	85.6	95.1	107.9	131.5	151.8
Small Signal	25.5	22.0	19.4	17.7	24.1	25.6	27.9	31.0	43.4	48.6
Power	46.2	45.5	46.3	42.9	48.6	50.6	57.1	65.4	75.1	87.2
Zener	7.1	6.7	6.4	6.9	9.0	9.4	10.1	11.5	13.0	16.0
Thyristor	15.1	19.4	14.8	16.2	21.1	22.3	24.7	29.0	33.5	38.7
Other	8.6	12.5	10.7	11.7	13.7	14.6	16.2	18.9	21.8	25.6
Total Optoelectronic	14.6	21.3	21.1	29.1	41.8	44.0	49.5	63.2	78.1	97.6
LED Lamps	2.7	1.6	2.3	3.1	6.7	7.1	7.9	9.9	11.9	13.9
LED Displays	8.0	11.7	10.1	14.2	18.7	19.8	22.2	28.8	35.7	45.0
Optical Couplers	1.2	1.9	2.3	2.7	3.6	3.8	4.3	5.2	5.8	7.0
Other	2.7	6.1	6.4	9.1	12.8	13.3	15.1	19.3	24.7	31.7

Source: DATAQUEST, Inc.
Ministry of International Trade and Industry (MITI, Japan)

Appendix A—Market Estimate Worksheets

Table A-15

ESTIMATED JAPANESE SEMICONDUCTOR FACTORY SHIPMENTS
(Billions of Yen)

	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
TOTAL SEMICONDUCTOR	200.1	246.9	346.2	347.1	276.3	454.1	485.6	529.1	637.2	864.2
Total Integrated Circuit	50.7	72.2	112.3	125.3	117.5	196.9	213.8	279.4	383.0	570.3
Bipolar Digital	18.9	15.1	24.6	31.4	22.6	31.5	37.2	40.6	51.1	72.6
TTL										
DTL										
ECL										
Other										
MOS	15.1	24.5	42.8	46.7	55.2	85.7	88.3	130.7	196.4	309.7
NMOS	0.0	0.0	0.3	1.2	5.6	17.7	31.4	81.3	133.7	219.9
PMOS	14.8	23.9	41.2	42.6	45.7	59.1	47.9	38.1	43.2	26.9
CMOS	0.3	0.6	1.3	2.9	3.9	8.9	9.0	11.3	19.5	62.9
Linear	16.7	32.6	44.9	47.2	39.7	79.7	88.3	108.1	135.5	188.0
Total Discrete	146.3	169.8	228.3	216.6	151.5	242.7	253.4	228.2	221.2	246.9
Transistor	83.2	94.2	130.2	128.2	90.6	140.3	139.9	115.1	104.5	113.8
Small Signal	51.7	64.3	93.1	90.6	56.2	89.4	82.2	70.0	57.8	61.7
Power Transistor	31.5	29.9	37.1	37.6	34.4	50.9	57.7	45.1	46.7	52.2
Diode	52.1	61.2	79.5	68.9	48.7	82.6	83.2	82.0	83.5	95.8
Small Signal	16.1	20.5	27.4	25.7	17.2	26.6	25.5	24.7	24.8	31.1
Power	32.2	36.2	45.9	35.6	26.1	48.0	49.7	48.4	49.6	55.5
Zener	3.8	4.5	6.2	7.6	5.4	8.0	8.0	8.9	9.1	9.2
Thyristor	7.9	7.5	12.4	13.4	8.0	13.6	18.6	17.7	18.4	20.9
Other	3.1	6.9	6.2	6.1	4.2	6.2	11.7	13.4	14.8	16.4
Total Optoelectronic	3.1	4.9	5.6	5.2	7.3	14.5	18.4	21.5	33.0	47.0
LED Lamps					0.9	1.8	1.6	2.7	7.1	13.7
LED Displays					2.9	6.2	8.8	10.9	13.1	18.2
Optical Couplers					0.9	0.9	0.8	1.7	2.4	3.1
Other					2.6	5.6	7.2	6.2	10.4	12.0

Source: DATAQUEST, Inc.
Ministry of International Trade and Industry (MITI, Japan)

Appendix A-Introduction

INTRODUCTION

Appendix A consists of a set of detailed tables that estimate semiconductor consumption and semiconductor factory shipments both worldwide and for four major geographical regions for the years 1973 through 1993. Semiconductor consumption tables are divided into historical data tables and forecast tables. Semiconductor factory shipments tables are historical data tables only. All historical tables begin with 1973 and end with 1982, while all forecast tables begin with 1980 and end with 1988 with an additional 1993 column. Please refer to the "Forecast" section for a discussion of the differences between historical and future dollar values. A list of Appendix A Tables detailing the type of data, region, years and units, is as follows:

LIST OF TABLES-APPENDIX A

Table	Region	Consumption/Production	Years	Units
A-0	Japan, Western Europe	Exchange Rates	1973-1982	Various
A-1	Worldwide	Consumption	1973-1982	Dollars
A-2	North America	Consumption	1973-1982	Dollars
A-3	Japan	Consumption	1973-1982	Dollars
A-4	Japan	Consumption	1973-1982	Yen
A-5	Westen Europe	Consumption	1973-1982	Dollars
A-6	Rest of World	Consumption	1973-1982	Dollars
A-7	Worldwide	Factory Shipments	1973-1982	Dollars
A-8	North America	Factory Shipments	1973-1982	Dollars
A-9	Japan	Factory Shipments	1973-1982	Dollars
A-10	Japan	Factory Shipments	1973-1982	Yen
A-11	Western Europe	Factory Shipments	1973-1982	Dollars
A-12	Rest of World	Factory Shipments	1973-1982	Dollars
A-13	Worldwide	Average Selling Price	1973-1982	Dollars
A-14	Worldwide	Consumption	1973-1982	Units
A-15	Worldwide	Consumption	1980-1988; 1993	Dollars
A-16	North America	Consumption	1980-1988; 1993	Dollars
A-17	Japan	Consumption	1980-1988; 1993	Dollars
A-18	Western Europe	Consumption	1980-1988; 1993	Dollars
A-19	Rest of World	Consumption	1980-1988; 1993	Dollars
A-20	Worldwide	Average Selling Price	1980-1988; 1993	Dollars
A-21	Worldwide	Consumption	1980-1988; 1933	Units

Source: DATAQUEST
May 1983

Appendix A-Introduction

Each table gives estimates for semiconductor consumption or factory shipments listed by the major product categories of semiconductor devices. In these tables, semiconductor components are divided into three major product groups: integrated circuits, discrete devices, and optoelectronic devices. These groups are divided into a number of subgroups, some of which are segmented further. Totals for each device group are presented at the bottom of the categories.

DEFINITIONS AND CONVENTIONS

DATAQUEST uses a common manufacturer base for all data tables. This base includes all merchant suppliers to the semiconductor market. It excludes captive suppliers that manufacture devices solely for the benefit of the parent company, such as Burroughs, IBM, and Western Electric. Included, however, are companies that actively market semiconductor devices to the merchant market as well as to other divisions of their own company. A recent case in point is NCR, previously a captive supplier, which in 1982 has offered products on the merchant market for the first time. For such companies, both external shipments and internal consumption are included. Devices that are used internally are valued at current market prices.

Consumption-For purposes of Appendix A, DATAQUEST defines consumption as the purchase of a semiconductor device or devices. This definition must be differentiated from actual use of the device in a final product. Devices that are inventoried at the user level are considered consumption according to our definition.

Factory Shipments Location-The fabrication and assembly of a semiconductor device may be performed in several different locations. For the purposes of Appendix A, factory shipments is defined geographically as occurring from that point where the device was tested and marked, irrespective of where the device was assembled or where the initial wafer fabrication was performed.

Hybrids-In earlier Appendix A editions, hybrid devices were included as a separate segment of integrated circuits. However, since hybrid devices are primarily a special packaging arrangement, this segment has been omitted. Hybrid devices manufactured by semiconductor companies are now included in the most appropriate product segment, usually in the linear segment.

Power Devices-The difference between low-power and high-power transistors is set at the 1-watt power handling capability. Power diodes are rated at 1 amp or higher, while small signal diodes are rated at less than 1 amp. Special discrete devices that are neither transistors, diodes, nor thyristors are categorized as Other.

Appendix A-Introduction

The manufacturer base product group definitions and guidelines for including value of output which we have used in our tables may differ from those used in other studies of this type. Our base is nearly the same as that used by the Semiconductor Industry Association (SIA).

Regions-North America is defined as including both the United States and Canada. Latin America, including Mexico, is considered part of the ROW category. Western Europe includes Austria, Belgium, the Federal Republic of Germany, France, Greece, Italy, Luxembourg, the Scandinavian countries (Denmark, Finland, Norway, Sweden), Spain and the United Kingdom.

DATA SOURCES

The information presented in Appendix A is a consolidation from a variety of fragmentary sources, each of which focuses on a specific part of the market.

- U.S. Commerce Department trade statistics and Semiconductor Trade Statistics Program, (STSP) marketing data are used in determining North American consumption and factory shipments.

- Japanese trade statistics, compiled and published by the Ministry of Finance and the Ministry of International Trade and Industry (MITI), are used to determine Japanese factory shipments and consumption in yen. STSP also details semiconductor sales by U.S. and Western European manufacturers to Japan.

- For West European markets, U.S. Department of Commerce trade statistics, marketing statistics from the Semiconductor Industry Association (SIA), and shipment estimates for each company are the primary data sources used.

- U.S. Commerce Department trade statistics STSP data, and MITI trade statistics constitute the major published sources used to estimate ROW consumption and factory shipments.

DATAQUEST believes that the estimates presented are the most accurate and meaningful generally available today. The sources of the data and the guidelines for the forecasts presented in the tables are:

- Unit sales or revenues (or both) published by major industry participants, both in the United States and abroad

- Estimates presented by knowledgeable and reliable industry spokesmen

- Government data or trade association data such as that from EIA, MITI, SIA, and the U.S. Department of Commerce

Appendix A-Introduction

- Published product literature and price lists
- Interviews with knowledgeable manufacturers, distributors, and users
- Relevant projected world economic data

CONSISTENCY

One of the key objectives in preparing these estimates is to achieve consistency among the various data elements that constitute the forecast and the past data base. To ensure the accuracy and consistency of the estimates, we compared the value of directly obtained data elements with values obtained by indirect means, wherever possible. Thus, the worldwide data in Appendix A is consistent with worldwide totals of the Market Share estimates in Appendix B. However, the regional factory shipments totals of Appendix B do not and should not equal the regional factory shipments totals of Appendix A because Appendix A includes factories of all national origin producing in Japan. This would include companies like Texas Instruments Japan.

ACCURACY

The tables presented here represent DATAQUEST estimates that we believe are reasonably accurate. Where we have no reasonable estimate, none is given. A blank space in a table indicates that a reasonably accurate estimate is unavailable, and a zero in a table represents an estimate.

VALUATION OF CONSUMPTION AND FACTORY SHIPMENTS

Regional consumption and factory shipments are all expressed in U.S. dollars, (In addition, Japan is expressed in yen.) To make the tables of Appendix A useful in comparing different regions, it is necessary to express all values in a common currency and, because of the U.S. producers' large presence in international markets, the dollar is the preferred choice.

However, the choice of the U.S. dollar (or any single currency, for that matter) as the currency basis for the tables, brings with it some problems that require the readers' careful consideration in interpreting the data.

Inflation

All countries that participate significantly in international semiconductor markets suffered from an overall price inflation in the 1970s, continuing into the 1980s.

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As a consequence, the dollar in a given year is not truly comparable with the dollar in any preceding year. Consumer and Wholesale Price Indices and GNP Deflators all measure price changes in various composite "market baskets" of goods. However, there is no price index that measures price changes of material, equipment, and labor inputs to the semiconductor industry. Indeed, the "mix" is changing so rapidly that what is used this year was sometimes unavailable last year, at any price. Nor is there a composite price index that measures price changes in aggregate semiconductor product. In an industry noted for its deflationary trends, this latter effect would tend to make the component purchaser's dollar worth more as time passed in terms of purchasing electronic capability.

We have made no adjustments in the historical data to account for these inflationary and deflationary effects. The data are expressed in current dollars (dollars that include the inflation rate and exchange rates of the given year) for all historical data, and comparisons between different years must be interpreted accordingly.

Average Selling Prices

When considering the worldwide Average Selling Prices (ASPs) for semiconductor components one must look at the price per function of a circuit, the complexity of the circuit, and the product mix according to this increasing complexity. It is true that one characteristic of the semiconductor industry is that the price per function for integrated circuits has been dropping an average of 30 percent per year for the last decade. At the same time, circuits are becoming denser resulting in an overall increase in the price of the device with a decreasing cost per function. Thus, Table A-20 shows the worldwide ASPs increasing after many years of decreasing due to the move towards higher complexity devices. There are also regional differences in ASPs due to regional competition differences and the varying regional product consumption mix. The worldwide ASP is truly an aggregate measure and may differ significantly from ASPs which exist in any specific market at any point in time.

Exchange Rates

Construction of the West European tables involves combining data from many countries, each of which has different and changing exchange rates. DATAQUEST uses International Monetary Fund average foreign exchange rates for each year, and, as far as possible, we prepare our estimates in terms of local currencies before conversion to U.S. dollars. The exchange rates for major currencies can be found in Table A-0 at the end of this introduction.

Japanese consumption and factory shipments are based on MITI data, which are originally expressed in yen. The Japanese data published in Appendix A are expressed in both dollars (A-4 and A-10) and in yen (A-3 and A-9). The yen/dollar exchange rate used for each year can be found in Table A-0. Because of the fluctuations in the exchange rate for the yen, the dollar values given tend to distort the growth rate of the Japanese market, but they do provide a useful basis for

regional market size comparisons. However, the data in yen give a better picture of the real growth in the Japanese market.

FORECAST

As mentioned previously, historical data are expressed in current dollars or dollars that include the given year's inflation rate and exchange rates. However, the consumption forecast, which appears in Tables A-15 through A-19, uses constant dollars and exchange rates, with no allowance for inflation or variations in the rates of exchange between countries. All estimates for 1982 and beyond are made as if 1982 monetary conditions will continue through 1993 and, therefore, shows the absolute growth year-to-year during this period.

Information on interregional trade and other analyses used in the preparation of these tables is available to DATAQUEST clients upon request.

Frederick L. Zieber
Barbara A. Van

Appendix A-Introduction

Table A-0

ANNUAL FOREIGN EXCHANGE RATES
(Expressed in U.S. Dollars)

Year	Japan: Dollars Per Yen	France: Dollars Per French Franc	West Germany: Dollars Per Deutsch Mark	United Kingdom: Dollars Per Pound Sterling
1970	$0.002795	$0.1810	$0.2744	$2.3963
1971	$0.002913	$0.1822	$0.2886	$2.4506
1972	$0.003311	$0.1985	$0.3140	$2.4878
1973	$0.003721	$0.2267	$0.3811	$2.4587
1974	$0.003427	$0.2099	$0.3897	$2.3524
1975	$0.003368	$0.2337	$0.4063	$2.2069
1976	$0.003376	$0.2091	$0.3998	$1.7960
1977	$0.003761	$0.2042	$0.4337	$1.7602
1978	$0.004857	$0.2251	$0.5051	$2.0260
1979	$0.004518	$0.2361	$0.5482	$2.1312
1980	$0.004449	$0.2335	$0.5463	$2.3241
1981	$0.004519	$0.1839	$0.4429	$1.8741
1982	$0.004022	$0.1523	$0.4123	$1.7418

Source: Federal Reserve Bulletin
DATAQUEST

Table A-1

HISTORICAL WORLDWIDE SEMICONDUCTOR CONSUMPTION*
(Millions of Dollars)
1973 through 1982

		1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	(73-82) CAG %
INTEGRATED CIRCUIT	BIPOLAR DIGITAL	929	979	682	865	1060	1320	1807	2450	2324	2438	11.32
	TTL	659	719	499	682	852	1046	1492	2117	2033	2135	13.95
	DTL	125	105	81	71	61	56	52	45	34	30	-14.66
	ECL	67	73	55	76	100	140	170	189	172	185	11.95
	OTHER	78	82	47	36	47	78	93	99	85	88	1.35
	MOS DIGITAL	587	880	837	1239	1564	2364	3480	4919	4671	5296	27.69
	CMOS	56	111	95	204	274	347	539	948	951	1050	38.50
	NMOS	13	72	133	377	696	1453	2384	3498	3335	3897	88.45
	PMOS	518	697	609	658	594	564	557	473	385	349	-4.29
	LINEAR	567	651	601	837	1097	1550	1960	2418	2645	2687	18.87
DISCRETE	TRANSISTOR	1361	1400	1063	1333	1429	1535	1586	1662	1907	1659	2.22
	SMALL SIGNAL	847	874	638	793	799	844	829	856	1024	844	-0.04
	POWER	514	526	425	540	630	691	757	806	883	815	5.26
	DIODE	887	944	709	911	997	1184	1286	1428	1405	1260	3.98
	SMALL SIGNAL	291	323	211	206	309	362	403	443	469	399	3.57
	POWER	480	482	398	504	559	657	711	792	746	685	4.03
	ZENER	116	139	100	121	129	165	172	193	190	176	4.74
	THYRISTOR	198	232	180	241	293	317	358	390	345	325	5.66
	OTHER	120	124	76	133	121	148	170	176	175	191	5.30
OPTO	LED LAMPS	19	23	32	54	65	89	113	130	156	156	26.36
	LED DISPLAYS	92	120	128	151	144	193	256	294	332	327	15.13
	OPTO COUPLERS	13	21	22	29	33	50	80	103	110	110	26.78
	OTHER	24	31	43	54	64	84	132	167	189	167	24.05
TOTAL	I C.	2083	2510	2120	2941	3721	5234	7255	9787	9640	10421	19.59
	DISCRETE	2566	2700	2028	2598	2040	3184	3400	3656	3832	3435	3.29
	OPTO	148	195	225	288	306	416	581	694	787	760	19.94
	SEMICONDUCTOR	4797	5405	4373	5827	6867	8834	11236	14137	14259	14616	13.10

*Columns may not add due to rounding

Note: Please see Introduction to Appendix A for discussion of terms and definitions. Exchange rates are given in Table A-0 at the end of the Introduction.

Source: DATAQUEST

Table A-2

HISTORICAL NORTH AMERICAN SEMICONDUCTOR CONSUMPTION*
(Millions of Dollars)
1973 through 1982

		1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	(73-82) CAG %
INTEGRATED CIRCUIT	BIPOLAR DIGITAL	521	573	362	486	593	721	1051	1507	1236	1360	11.32
	TTL											
	DTL											
	ECL											
	OTHER											
	MOS DIGITAL	280	442	432	660	845	1151	1704	2512	2455	2785	29.00
	CMOS											
	NMOS											
	PMOS											
	LINEAR	225	244	224	270	357	405	580	733	890	897	16.61
DISCRETE	TRANSISTOR	393	431	339	400	405	451	521	516	574	484	2.34
	SMALL SIGNAL	210	240	179	208	194	219	241	234	269	218	0.42
	POWER	183	191	160	192	211	232	280	282	305	266	4.24
	DIODE	297	297	223	265	291	314	376	391	395	369	2.44
	SMALL SIGNAL	94	94	52	65	60	55	61	63	72	70	-3.22
	POWER	155	149	128	153	174	182	235	246	242	220	3.97
	ZENER	48	54	43	47	57	77	80	82	81	79	5.69
	THYRISTOR	74	81	60	83	100	106	130	128	121	108	4.29
	OTHER	74	75	42	41	36	45	48	46	45	53	-3.64
OPTO	LED LAMPS	9	12	13	15	15	20	29	30	29	37	17.01
	LED DISPLAYS	64	83	86	90	59	85	98	96	95	88	3.60
	OPTO COUPLERS	9	13	13	17	17	21	44	54	56	54	22.03
	OTHER	10	13	16	22	24	30	57	60	61	54	20.61
TOTAL	I.C.	1026	1259	1018	1418	1795	2357	3415	4752	4581	5050	19.37
	DISCRETE	838	884	664	789	832	916	1075	1081	1135	1014	2.14
	OPTO	92	121	128	144	115	156	228	240	241	233	10.88
	SEMICONDUCTOR	1956	2264	1810	2351	2742	3429	4718	6073	5957	6297	13.87

*Columns may not add due to rounding

Note: Please see Introduction to Appendix A for discussion of terms and definitions. Exchange rates are given in Table A-0 at the end of the Introduction.

Source: DATAQUEST
U.S. Department of Commerce,
Bureau of the Census,
Semiconductor Trade Statistics
Program (STSP)

Table A-3

HISTORICAL JAPANESE SEMICONDUCTOR CONSUMPTION*
(Millions of Dollars)
1973 through 1982

		1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	(73-82) CAG %
INTEGRATED CIRCUIT	BIPOLAR DIGITAL	110	135	101	156	280	263	299	348	525	527	19.02
	TTL											
	DTL											
	ECL											
	OTHER											
	MOS DIGITAL	180	248	203	286	328	602	701	1091	1152	1315	24.73
	CMOS											
	NMOS											
	PMOS											
	LINEAR	160	168	147	271	359	550	619	795	986	957	21.33
DISCRETE	TRANSISTOR	418	424	311	441	483	498	426	469	658	491	1.80
	SMALL SIGNAL	307	302	189	293	308	308	260	279	392	276	-1.10
	POWER	111	122	122	148	175	190	166	190	266	215	7.62
	DIODE	242	248	168	266	279	353	313	370	451	346	4.05
	SMALL SIGNAL	92	97	71	86	83	97	84	111	175	127	3.65
	POWER	127	125	79	156	171	225	190	219	232	185	4.27
	ZENER	23	26	18	24	25	31	31	40	44	34	4.44
	THYRISTOR	28	39	29	51	73	75	76	94	85	74	11.40
	OTHER	19	20	11	29	47	52	53	61	72	77	16.82
OPTO	LED LAMPS	4	4	5	9	8	16	20	38	51	46	31.18
	LED DISPLAYS	12	16	16	27	44	49	64	83	125	116	28.67
	OPTO COUPLERS	1	3	3	4	7	11	13	16	22	21	40.25
	OTHER	7	9	11	9	22	31	41	54	80	67	28.53
TOTAL	I.C.	450	551	451	713	807	1415	1699	2234	2663	2799	22.20
	DISCRETE	707	731	519	707	882	978	868	994	1266	988	3.79
	OPTO	24	32	35	49	81	107	138	183	278	250	29.74
	SEMICONDUCTOR	1189	1314	1005	1549	1850	2500	2705	3411	4207	4037	14.55

*Columns may not add due to rounding

Note: Value of Japanese consumption has been translated from yen to dollars at exchange rate applicable during estimate period. Exchange rates are given in Table A-0 at the end of the Introduction. See Table 4 for yen value of Japanese semiconductor consumption.

Source: DATAQUEST
Ministry of International Trade and Industry (MITI, Japan)

Table A-4

HISTORICAL JAPANESE SEMICONDUCTOR CONSUMPTION*
(Billions of Yen)
1973 through 1982

		1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	(73-82) CAG %
INTEGRATED CIRCUIT	BIPOLAR DIGITAL	29.56	39.39	29.99	46.21	53.18	54.55	66.30	78.10	115.80	131.10	18.00
	TTL											
	DTL											
	ECL											
	OTHER											
	MOS DIGITAL	48.37	72.37	60.27	84.71	87.22	124.85	172.79	245.18	253.90	326.80	23.65
	CMOS											
	NMOS											
	PMOS											
	LINEAR	45.14	49.02	43.64	80.27	95.46	114.07	136.90	178.70	217.49	237.93	20.28
DISCRETE	TRANSISTOR	112.32	123.72	92.34	130.62	128.43	103.29	94.27	105.38	145.09	122.06	0.93
	SMALL SIGNAL	82.49	88.12	56.11	86.79	81.90	63.88	57.54	62.69	86.44	68.61	-2.03
	POWER	29.83	35.60	36.22	43.84	46.53	39.41	36.74	42.69	58.65	53.45	6.70
	DIODE	65.03	72.37	49.88	78.79	74.19	73.21	69.27	83.14	99.45	86.02	3.16
	SMALL SIGNAL	24.72	28.30	21.08	25.47	22.07	20.12	18.59	24.94	38.59	31.57	2.76
	POWER	34.12	36.48	23.46	46.21	45.47	46.67	43.82	49.21	51.16	45.99	3.37
	ZENER	6.18	7.59	5.34	7.11	6.65	6.43	6.86	8.99	9.70	8.45	3.54
	THYRISTOR	7.52	11.38	8.61	15.11	19.41	15.56	16.82	21.12	18.74	18.40	10.44
	OTHER	5.11	5.84	3.27	8.59	12.50	10.78	11.73	13.71	15.88	19.14	15.82
OPTO	LED LAMPS	1.07	1.17	1.48	2.67	2.13	3.32	4.43	6.74	11.25	11.44	30.05
	LED DISPLAYS	3.22	4.67	4.75	8.00	11.70	10.16	14.16	18.65	27.56	28.84	27.56
	OPTO COUPLERS	0.27	0.88	0.89	1.18	1.86	2.28	2.88	3.60	4.85	5.22	39.05
	OTHER	1.88	2.63	3.27	2.67	5.85	6.43	9.07	12.13	17.64	16.66	27.42
TOTAL	I.C.	123.06	160.78	133.90	211.19	235.85	293.47	375.99	501.98	587.19	695.83	21.23
	DISCRETE	189.97	213.31	154.09	233.11	234.52	202.84	192.09	223.35	279.15	245.62	2.90
	OPTO	6.45	9.34	10.39	14.51	21.54	22.19	30.54	41.12	61.30	62.15	28.63
	SEMICONDUCTOR	319.48	383.43	298.38	458.81	491.92	518.50	598.62	766.45	927.64	1003.6	13.56

*Columns may not add due to rounding

Note: Please see Introduction to Appendix A for discussion of terms and definitions.

Source: DATAQUEST
Ministry of International Trade and Industry (MITI, Japan)

Table A-5

HISTORICAL WESTERN EUROPEAN SEMICONDUCTOR CONSUMPTION*
(Millions of Dollars)
1973 through 1982

		1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	(73-82) CAG %
INTEGRATED CIRCUIT	BIPOLAR DIGITAL	263	229	189	186	228	291	390	510	454	434	5.72
	TTL											
	DTL											
	ECL											
	OTHER											
	MOS DIGITAL	109	168	150	226	352	535	781	1139	882	948	27.17
	CMOS											
	NMOS											
	PMOS											
	LINEAR	160	221	214	264	324	412	576	684	556	606	15.95
DISCRETE	TRANSISTOR	474	463	351	400	424	463	511	511	463	468	-0.14
	SMALL SIGNAL	291	289	243	248	244	265	286	275	251	247	-1.81
	POWER	183	174	108	152	180	198	225	236	212	221	2.12
	DIODE	320	362	282	318	342	402	460	503	384	391	2.25
	SMALL SIGNAL	92	112	72	117	139	182	228	225	157	154	5.89
	POWER	185	194	173	163	170	184	194	231	192	202	0.90
	SENER	43	56	37	38	33	36	38	47	35	35	-2.26
	THYRISTOR	88	100	82	99	97	110	118	133	103	105	1.98
	OTHER	18	19	13	34	18	29	49	45	45	47	11.25
OPTO	LED LAMPS	6	6	10	23	27	35	42	41	41	44	24.78
	LED DISPLAYS	10	13	17	22	26	41	54	58	57	65	23.12
	OPTO COUPLERS	3	4	5	5	6	10	19	27	27	28	28.17
	OTHER	6	6	12	17	9	11	18	35	29	31	20.02
TOTAL	I.C.	532	618	561	676	904	1238	1747	2333	1892	1988	15.77
	DISCRETE	900	944	728	851	881	1004	1138	1192	995	1011	1.30
	OPTO	25	29	44	67	68	97	133	161	154	168	23.57
	SEMICONDUCTOR	1457	1591	1333	1594	1853	2339	3018	3686	3041	3167	9.01

*Columns may not add due to rounding

Note: Please see Introduction to Appendix A for discussion of terms and definitions. Exchange rates are given in Table A-0 at the end

Source: DATAQUEST

Table A-6

HISTORICAL REST OF WORLD SEMICONDUCTOR CONSUMPTION*
(Millions of Dollars)
1973 through 1982

		1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	(73-82) CAG %
INTEGRATED CIRCUIT	BIPOLAR DIGITAL	35	42	30	35	39	45	67	85	109	109	13.45
	TTL											
	DTL											
	ECL											
	OTHER											
	MOS DIGITAL	18	22	44	67	88	110	134	177	182	248	33.84
	CMOS											
	NMOS											
	PMOS											
	LINEAR	14	18	16	32	57	103	193	206	213	227	36.28
DISCRETE	TRANSISTOR	76	82	62	92	117	123	128	166	212	216	12.31
	SMALL SIGNAL	39	43	27	44	53	52	42	68	112	103	11.39
	POWER	37	39	35	48	64	71	86	98	100	113	13.21
	DIODE	28	37	36	62	85	115	137	164	175	154	20.85
	SMALL SIGNAL	13	20	16	18	27	28	30	44	65	48	15.62
	POWER	13	14	18	32	44	66	84	96	80	78	22.03
	ZENER	2	3	2	12	14	21	23	24	30	28	34.07
	THYRISTOR	8	12	9	8	23	26	34	35	36	38	18.90
	OTHER	9	10	10	9	20	22	20	24	13	14	5.03
OPTO	LED LAMPS	0	1	4	7	15	18	22	29	35	29	N/A
	LED DISPLAYS	6	8	9	12	15	18	40	57	55	58	28.67
	OPTO COUPLERS	0	1	1	3	3	8	4	6	5	7	N/A
	OTHER	1	3	4	6	9	12	16	18	19	15	35.11
TOTAL	I.C.	67	82	90	134	184	258	394	468	504	584	27.20
	DISCRETE	121	141	117	171	245	286	319	389	436	422	14.89
	OPTO	7	13	18	28	42	56	82	110	114	109	35.67
	SEMICONDUCTOR	195	236	225	333	471	600	795	967	1054	1115	21.38

*Columns may not add due to rounding

Note: Please see Introduction to Appendix A for discussion of terms and definitions. Exchange rates are given in Table A-0 at the end of the Introduction.

Source: DATAQUEST

Table A-7

HISTORICAL WORLDWIDE SEMICONDUCTOR FACTORY SHIPMENTS*
(Millions of Dollars)
1973 through 1982

		1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	(73-82) CAG %
INTEGRATED CIRCUIT	BIPOLAR DIGITAL	929	979	682	865	1060	1320	1807	2450	2324	2438	11.32
	TTL	659	719	499	682	852	1046	1492	2117	2033	2135	13.95
	DTL	125	105	81	71	61	56	52	45	34	30	-14.66
	ECL	67	73	55	76	100	140	170	189	172	185	11.95
	OTHER	78	82	47	36	47	78	93	99	85	88	1.35
	MOS DIGITAL	507	880	837	1239	1564	2364	3480	4919	4671	5296	27.69
	CMOS	56	111	95	204	274	347	539	948	951	1050	38.50
	NMOS	13	72	133	377	696	1453	2384	3498	3335	3897	88.45
	PMOS	518	697	609	658	594	564	557	473	385	349	-4.29
	LINEAR	567	651	601	837	1097	1550	1968	2418	2645	2687	18.87
DISCRETE	TRANSISTOR	1361	1400	1063	1333	1429	1535	1586	1662	1907	1659	2.22
	SMALL SIGNAL	847	874	638	793	799	844	829	856	1024	844	-0.04
	POWER	514	526	425	540	630	691	757	806	883	815	5.26
	DIODE	887	944	709	911	997	1184	1286	1428	1405	1260	3.98
	SMALL SIGNAL	291	323	211	286	309	362	403	443	469	399	3.57
	POWER	480	482	398	504	559	657	711	792	746	685	4.03
	ZENER	116	139	100	121	129	165	172	193	190	176	4.74
	THYRISTOR	198	232	180	241	293	317	358	390	345	325	5.66
	OTHER	120	134	76	113	121	148	170	176	175	191	5.30
OPTO	LED LAMPS	19	23	32	54	65	89	113	130	156	156	26.36
	LED DISPLAYS	92	120	128	151	144	193	256	294	332	327	15.13
	OPTO COUPLERS	13	21	22	29	33	50	80	103	110	110	26.78
	OTHER	24	31	43	54	64	84	132	167	189	167	24.05
TOTAL	I.C.	2003	2510	2120	2941	3721	5234	7255	9787	9640	10421	19.59
	DISCRETE	2566	2700	2028	2598	2840	3184	3400	3656	3832	3435	3.29
	OPTO	148	195	225	288	306	416	581	694	787	760	19.94
	SEMICONDUCTOR	4797	5405	4373	5827	6867	8834	11236	14137	14259	14616	13.18

*Columns may not add due to rounding

Note: Please see Introduction to Appendix A for discussion of terms and definitions. Exchange rates are given in Table A-0 at the end of the Introduction.

Source: DATAQUEST

Table A-8

HISTORICAL NORTH AMERICAN SEMICONDUCTOR FACTORY SHIPMENTS*
(Millions of Dollars)
1973 through 1982

		1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	(73-82) CAG %
INTEGRATED CIRCUIT	BIPOLAR DIGITAL	576	595	395	505	655	797	1093	1500	1353	1365	10.06
	TTL	448	470	303	410	571	686	955	1336	1208	1225	11.83
	DTL	61	49	43	41	34	33	36	21	15	13	-15.76
	ECL	41	45	33	39	40	57	77	98	90	88	8.86
	OTHER	26	31	16	15	10	21	31	45	40	39	4.61
	MOS DIGITAL	383	595	530	791	985	1348	2063	2689	2410	2592	23.67
	CMOS	48	94	77	163	218	258	391	543	506	531	30.61
	NMOS	12	66	100	301	525	900	1486	1948	1746	1891	75.46
	PMOS	323	435	353	327	242	190	186	198	158	170	-6.80
	LINEAR	253	309	283	316	421	542	739	929	923	970	16.10
DISCRETE	TRANSISTOR	440	468	368	418	429	495	569	577	610	483	1.04
	SMALL SIGNAL	230	254	189	225	215	252	287	289	288	216	-0.70
	POWER	210	214	179	193	214	243	282	288	322	267	2.70
	DIODE	286	327	256	300	322	331	396	458	442	405	3.94
	SMALL SIGNAL	73	95	62	73	72	47	58	60	62	51	-3.91
	POWER	159	169	142	164	187	193	239	285	279	261	5.66
	ZENER	54	63	52	63	63	91	99	113	101	93	6.23
	THYRISTOR	95	102	75	104	111	110	128	140	134	112	1.85
	OTHER	75	86	52	67	52	39	37	45	24	41	-6.49
OPTO	LED LAMPS	10	13	15	19	21	25	30	27	24	24	10.22
	LED DISPLAYS	73	98	98	99	69	80	117	110	108	100	3.56
	OPTO COUPLERS	9	15	14	20	19	28	49	60	56	52	21.52
	OTHER	11	18	25	26	19	28	54	60	62	57	20.06
TOTAL	I.C.	1212	1499	1216	1612	2061	2687	3895	5118	4686	4927	16.86
	DISCRETE	896	983	751	889	914	975	1130	1220	1210	1041	1.68
	OPTO	103	144	152	164	128	161	250	257	250	233	9.49
	SEMICONDUCTOR	2211	2626	2119	2665	3103	3823	5275	6595	6146	6201	12.14

*Columns may not add due to rounding

Note: Please see Introduction to Appendix A for discussion of terms and definitions. Exchange rates are given in Table A-0 at the end of the Introduction.

Source: DATAQUEST
Semiconductor Statistics
Trade Program (STSP)

Table A-9

HISTORICAL JAPANESE SEMICONDUCTOR FACTORY SHIPMENTS*
(Millions of Dollars)
1973 through 1982

		1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	(73-82) CAG %
INTEGRATED CIRCUIT	BIPOLAR DIGITAL	92	100	76	106	140	196	231	323	428	537	21.66
	TTL											
	DTL											
	ECL											
	OTHER											
	MOS DIGITAL	159	160	186	290	332	630	887	1379	1560	1944	32.07
	CMOS	5	10	13	30	34	54	88	280	325	359	60.78
	NMOS	1	4	19	60	118	392	604	979	1133	1495	125.29
	PMOS	153	146	154	200	180	184	195	120	102	90	-5.73
	LINEAR	167	161	134	269	332	524	612	837	1155	1085	23.11
DISCRETE	TRANSISTOR	484	439	305	474	526	555	472	507	709	502	3.18
	SMALL SIGNAL	346	310	189	302	309	338	261	275	392	290	-0.74
	POWER	138	129	116	172	217	217	211	232	317	292	9.50
	DIODE	296	240	164	277	313	395	377	426	530	414	5.86
	SMALL SIGNAL	102	88	58	88	96	119	112	138	218	170	7.59
	POWER	171	134	88	162	187	233	224	247	263	208	5.01
	ZENER	23	26	18	27	30	43	41	41	49	36	3.68
	THYRISTOR	46	46	27	46	70	86	83	93	94	79	6.19
	OTHER	23	21	11	21	44	65	67	73	93	96	18.40
OPTO	LED LAMPS	3	2	3	6	6	13	32	61	81	79	50.45
	LED DISPLAYS	10	8	10	21	33	53	59	81	113	108	33.53
	OPTO COUPLERS	2	2	3	3	3	8	11	14	23	25	32.40
	OTHER	3	4	6	8	27	30	45	53	73	69	37.22
TOTAL	I.C.	418	429	396	665	804	1350	1730	2539	3143	3566	26.90
	DISCRETE	849	754	507	818	953	1101	999	1099	1426	1171	5.01
	OPTO	18	16	22	38	69	104	147	209	290	281	37.50
	SEMICONDUCTOR	1285	1199	925	1521	1826	2555	2876	3847	4859	5018	16.34

*Columns may not add due to rounding

Note: Value of Japanese consumption has been translated from yen to dollars at exchange rate applicable during estimate period. Exchange rates are given in Table A-0 at the end of the Introduction. See Table 10 for yen value of Japanese semiconductor consumption.

Source: DATAQUEST
Ministry of International Trade and Industry (MITI, Japan)

Table A-10

HISTORICAL JAPANESE SEMICONDUCTOR FACTORY SHIPMENTS*
(Billions of Yen)
1973 through 1982

		1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	(73-82) CAG %
INTEGRATED CIRCUIT	BIPOLAR DIGITAL	24.72	31.51	22.56	31.40	37.23	40.65	51.12	72.58	94.37	133.50	20.61
	TTL											
	DTL											
	ECL											
	OTHER											
	MOS DIGITAL	42.72	46.69	55.22	85.90	88.28	130.66	196.29	309.86	343.98	483.28	30.94
	CMOS	1.34	2.92	3.86	8.89	9.04	11.20	19.47	62.92	71.66	89.25	59.40
	NMOS	0.27	1.17	5.64	17.77	31.18	81.30	133.67	219.98	249.83	371.66	123.35
	PMOS	41.11	42.60	45.72	59.24	47.86	38.16	43.15	26.96	22.49	22.37	-6.54
	LINEAR	44.87	46.98	39.78	79.68	88.28	108.06	135.44	188.07	254.68	269.73	22.05
DISCRETE	TRANSISTOR	130.05	128.10	90.55	140.40	139.86	115.11	104.45	113.92	156.33	144.69	1.19
	SMALL SIGNAL	92.97	90.46	56.11	89.45	82.16	70.10	57.76	61.79	86.44	72.09	-2.79
	POWER	37.08	37.64	34.44	50.95	57.70	45.01	46.69	52.13	69.90	72.59	7.75
	DIODE	79.54	72.37	48.69	82.05	83.23	81.92	83.43	95.72	116.87	102.92	2.91
	SMALL SIGNAL	27.41	25.68	17.22	26.07	25.53	24.68	24.79	31.01	48.07	42.26	4.93
	POWER	45.95	39.10	26.13	47.98	49.72	48.32	49.57	55.50	57.99	51.71	1.32
	ZENER	6.18	7.59	5.34	8.00	7.98	8.92	9.07	9.21	10.80	8.95	4.20
	THYRISTOR	12.36	13.42	8.02	13.63	18.61	17.84	18.37	20.90	20.73	19.64	5.28
	OTHER	6.18	6.13	3.27	6.22	11.70	13.48	14.83	16.40	20.51	23.87	16.20
OPTO	LED LAMPS	0.81	0.58	0.89	1.78	1.60	2.70	7.08	13.71	17.86	19.64	42.59
	LED DISPLAYS	2.69	2.33	2.97	6.22	8.77	10.99	13.06	18.20	24.92	26.85	29.14
	OPTO COUPLERS	0.54	0.58	0.89	0.89	0.80	1.66	2.43	3.15	5.07	6.22	31.26
	OTHER	0.81	1.17	1.78	2.37	7.18	6.22	9.96	11.91	16.10	17.15	40.46
TOTAL	I.C.	112.32	125.18	117.57	196.97	213.78	279.37	382.85	570.51	693.03	886.51	25.80
	DISCRETE	228.13	220.02	150.53	242.29	253.40	228.35	221.08	246.95	314.43	291.11	2.75
	OPTO	4.84	4.67	6.53	11.26	18.35	21.57	32.53	46.96	63.95	69.86	34.54
	SEMICONDUCTOR	345.28	349.87	274.63	450.52	485.53	529.28	636.46	864.42	1071.4	1247.5	15.34

*Columns may not add due to rounding

Note: Please see Introduction to Appendix A for discussion of terms and definitions.

Source: DATAQUEST
Ministry of International Trade and Industry (MITI, Japan)

Table A-11

HISTORICAL WESTERN EUROPEAN SEMICONDUCTOR FACTORY SHIPMENTS*
(Millions of Dollars)
1973 through 1982

		1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	(73-82) CAG %
INTEGRATED CIRCUIT	BIPOLAR DIGITAL	243	246	181	187	206	259	386	509	433	436	6.71
	TTL											
	DTL											
	ECL											
	OTHER											
	MOS DIGITAL	45	122	108	152	238	364	481	780	621	660	34.77
	CMOS	3	7	5	11	22	32	45	90	80	96	46.97
	NMOS	0	2	6	16	53	153	279	550	429	486	N/A
	PMOS	42	113	97	125	163	179	157	140	112	78	7.12
	LINEAR	137	163	168	220	306	441	564	587	492	544	16.56
DISCRETE	TRANSISTOR	396	443	350	385	415	421	443	462	448	455	1.56
	SMALL SIGNAL	230	260	220	215	222	197	199	208	237	233	0.14
	POWER	166	183	130	170	193	224	244	254	211	222	3.28
	DIODE	296	349	276	322	348	433	481	501	374	383	2.90
	SMALL SIGNAL	107	120	78	113	127	176	215	222	155	149	3.75
	POWER	150	179	168	178	185	229	238	246	189	201	3.31
	ZENER	39	50	30	31	36	28	28	33	30	33	-1.84
	THYRISTOR	57	84	78	91	111	118	142	151	111	120	9.41
	OTHER	22	17	13	25	24	40	61	53	54	48	9.06
OPTO	LED LAMPS	6	6	10	23	35	47	41	32	39	43	24.46
	LED DISPLAYS	7	9	13	20	31	44	53	54	56	66	28.31
	OPTO COUPLERS	2	3	3	4	9	13	17	25	27	28	34.07
	OTHER	6	6	9	14	14	24	27	46	44	31	20.02
TOTAL	I.C.	425	531	457	559	750	1064	1431	1876	1546	1640	16.19
	DISCRETE	771	893	717	823	898	1012	1127	1167	907	1014	3.09
	OPTO	21	24	35	61	89	128	138	157	166	168	25.99
	SEMICONDUCTOR	1217	1448	1209	1443	1737	2204	2696	3200	2699	2822	9.80

*Columns may not add due to rounding

Note: Please see Introduction to Appendix A for discussion of terms and definitions. Exchange rates are given in Table A-0 at the end of the Introduction.

Source: DATAQUEST

Table A-12

HISTORICAL REST OF WORLD SEMICONDUCTOR FACTORY SHIPMENTS*
(Millions of Dollars)
1973 through 1982

		1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	(73-82) CAG %
INTEGRATED CIRCUIT	BIPOLAR DIGITAL	18	30	38	67	59	68	97	118	110	100	20.99
	TTL											
	DTL											
	ECL											
	OTHER											
	MOS DIGITAL	0	3	5	6	9	22	49	71	80	100	N/A
	CMOS	0	0	0	0	0	3	15	35	40	64	N/A
	NMOS	0	0	0	0	0	8	15	21	27	35	N/A
	PMOS	0	3	5	6	9	11	19	15	13	11	N/A
	LINEAR	10	18	16	32	38	43	53	65	75	88	27.33
DISCRETE	TRANSISTOR	41	50	40	56	59	64	102	116	140	139	14.53
	SMALL SIGNAL	41	50	40	51	53	57	82	84	107	105	11.01
	POWER	0	0	0	5	6	7	20	32	33	34	N/A
	DIODE	9	20	13	12	14	25	32	43	59	58	23.00
	SMALL SIGNAL	9	20	13	12	14	20	18	23	34	29	13.80
	POWER	0	0	0	0	0	2	10	14	15	15	N/A
	ZENER	0	0	0	0	0	3	4	6	10	14	N/A
	THYRISTOR	0	0	0	0	1	3	5	6	6	6	N/A
	OTHER	0	0	0	0	1	4	5	5	4	6	N/A
OPTO	LED LAMPS	0	2	4	6	3	4	10	10	12	10	N/A
	LED DISPLAYS	2	5	7	11	11	16	27	49	55	53	43.93
	OPTO COUPLERS	0	1	2	2	2	1	3	4	4	5	N/A
	OTHER	4	3	3	6	4	2	6	8	10	10	10.72
TOTAL	I.C.	28	51	51	105	106	133	199	254	265	288	29.56
	DISCRETE	50	70	53	68	75	96	144	170	209	209	17.22
	OPTO	6	11	16	25	28	23	46	71	81	78	32.98
	SEMICONDUCTOR	84	132	120	198	201	252	389	495	555	575	23.83

*Columns may not add due to rounding

Note: Please see Introduction to Appendix A for discussion of terms and definitions. Exchange rates are given in Table A-0 at the end of the Introduction.

Source: DATAQUEST

Table A-13

HISTORICAL WORLDWIDE AVERAGE SELLING PRICES*
(Dollars)
1973 through 1982

		1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
INTEGRATED CIRCUIT	BIPOLAR DIGITAL	0.69	0.65	0.60	0.61	0.66	0.63	0.57	0.70	0.70	0.62
	TTL										
	DTL										
	ECL										
	OTHER										
	MOS DIGITAL	5.32	4.06	2.75	2.39	2.06	1.91	1.92	1.87	1.86	1.85
	CMOS	2.55	1.50	0.78	0.73	0.68	0.59	0.60	0.62	0.64	0.63
	NMOS	4.90	4.80	4.43	4.71	4.46	4.46	4.30	4.40	4.43	4.45
	PMOS	6.14	5.45	4.01	4.18	3.01	1.92	1.80	1.75	1.70	1.70
	LINEAR	1.01	0.95	0.90	0.85	0.83	0.84	0.78	0.81	0.81	0.79
DISCRETE	TRANSISTOR	0.27	0.24	0.22	0.19	0.19	0.18	0.17	0.16	0.15	0.14
	SMALL SIGNAL	0.19	0.17	0.15	0.13	0.12	0.11	0.10	0.09	0.09	0.08
	POWER	0.85	0.74	0.68	0.73	0.78	0.73	0.70	0.68	0.56	0.54
	DIODE	0.11	0.10	0.10	0.09	0.08	0.08	0.07	0.07	0.07	0.07
	SMALL SIGNAL	0.06	0.06	0.05	0.05	0.04	0.04	0.04	0.04	0.04	0.04
	POWER	0.18	0.16	0.15	0.14	0.14	0.13	0.12	0.11	0.10	0.09
	ZENER	0.23	0.20	0.17	0.15	0.15	0.18	0.11	0.14	0.14	0.13
	THYRISTOR	0.91	0.86	0.83	0.89	0.92	0.91	0.89	0.98	1.09	0.95
	OTHER	1.38	1.28	1.01	0.88	0.72	0.63	0.33	0.26	0.26	0.23
OPTO	LED LAMPS						0.15	0.18	0.13	0.12	0.12
	LED DISPLAYS						1.32	1.40	1.45	1.50	1.30
	OPTO COUPLERS						0.80	0.78	0.83	0.77	0.70
	OTHER						0.85	0.72	0.90	1.07	1.11
TOTAL	I.C.	1.03	1.04	1.00	1.01	1.01	1.01	0.97	1.08	1.06	1.02
	DISCRETE	0.19	0.18	0.16	0.15	0.14	0.13	0.12	0.12	0.11	0.11
	OPTO	1.24	1.02	0.86	0.67	0.45	0.47	0.53	0.46	0.41	0.39
	SEMICONDUCTOR	0.31	0.30	0.29	0.28	0.28	0.29	0.31	0.34	0.31	0.33

*Columns may not add due to rounding

Note: Please see Introduction to Appendix A for discussion of terms and definitions. Exchange rates are given in Table A-0 at the end of the Introduction.

Source: DATAQUEST

Table A-14

HISTORICAL WORLDWIDE SEMICONDUCTOR CONSUMPTION*
(Millions of Units)
1973 through 1982

		1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	(73-82) CAGR %
INTEGRATED CIRCUIT	BIPOLAR DIGITAL	1346	1506	1137	1418	1606	2095	3170	3500	3320	3932	12.65
	TTL											
	DTL											
	ECL											
	OTHER											
	MOS DIGITAL	110	217	304	518	759	1238	1813	2630	2511	2863	43.59
	CMOS											
	NMOS											
	PMOS											
	LINEAR	561	685	668	985	1322	1845	2523	2913	3265	3401	22.16
DISCRETE	TRANSISTOR	5063	5052	4870	6040	7466	8619	9371	10696	12955	12059	10.12
	SMALL SIGNAL	4458	5141	4253	6180	6658	7673	8290	9511	11378	10550	10.04
	POWER	605	711	625	740	808	947	1081	1185	1577	1509	10.70
	DIODE	8021	9091	7462	10127	12578	15021	17564	19654	20542	18940	10.02
	SMALL SIGNAL	4850	5383	4220	5720	7725	9050	10075	11075	11725	9975	8.34
	POWER	2667	3013	2653	3600	3993	5054	5925	7200	7460	7611	12.36
	ZENER	504	695	588	807	860	917	1564	1379	1357	1354	11.60
	THYRISTOR	218	270	217	271	318	348	402	398	317	342	5.16
	OTHER	87	97	75	120	168	235	515	677	673	830	28.50
OPTO	LED LAMPS						582	638	1000	1300	1357	
	LED DISPLAYS						146	183	203	221	252	
	OPTO COUPLERS						62	101	124	143	156	
	OTHER						99	184	186	176	151	
TOTAL	I.C.	2018	2408	2109	2921	3687	5178	7506	9044	9097	10196	19.72
	DISCRETE	13388	15309	12632	17366	20530	24223	27852	31425	34486	32172	10.23
	OPTO	119	191	262	430	680	889	1106	1513	1841	1915	36.12
	SEMICONDUCTOR	15526	17909	15002	20717	24897	30291	36464	41981	45424	44283	12.35

*Columns may not add due to rounding

Note: Please see Introduction to Appendix A for discussion of terms and definitions. Exchange rates are given in Table A-0 at the end of the Introduction.

Source: DATAQUEST

Table A-15

WORLDWIDE SEMICONDUCTOR CONSUMPTION FORECAST*
(Millions of Dollars)
1980 through 1988, plus 1993

		1980	1981	1982	1983	1984	1985	1986	1987	1988	(82-88) CAG %	1993	(88-93) CAG %
INTEGRATED CIRCUIT	BIPOLAR DIGITAL	2450	2324	2438	2707	3110	3496	3897	4246	4634	11.32	7138	9.02
	TTL	2117	2033	2135									
	DTL	45	34	30									
	ECL	189	172	185									
	OTHER	99	85	88									
	MOS DIGITAL	4919	4671	5234	6483	8086	12171	16279	20951	26266	30.66	88223	27.42
	CMOS	948	951	1050	1505	1950	2875	4125	5675	7950	39.63	35000	35.19
	NMOS	3498	3335	3897	4784	6556	9021	11899	15061	18361	29.54	53150	23.69
	PMOS	473	385	349	320	300	275	255	215	155	-12.68	65	-15.95
	LINEAR	2418	2645	2687	3135	3837	4691	5664	6755	7928	19.80	17983	17.80
DISCRETE	TRANSISTOR	1662	1907	1659	1729	1877	2097	2310	2553	2817	9.24	4103	7.81
	SMALL SIGNAL	856	1024	844	872	931	1015	1084	1170	1259	6.91	1602	4.94
	POWER	806	883	815	857	946	1082	1226	1383	1558	11.43	2501	9.93
	DIODE	1428	1405	1260	1334	1453	1611	1776	1952	2137	9.22	3207	8.46
	SMALL SIGNAL	443	469	399	414	442	478	512	550	591	6.78	765	5.30
	POWER	792	746	685	738	815	915	1027	1142	1265	10.79	2048	10.12
	SENSOR	193	190	176	182	196	218	237	260	281	8.13	394	6.99
	THYRISTOR	390	345	325	347	384	430	477	533	589	10.44	1006	11.30
	OTHER	176	175	191	202	223	248	270	301	333	9.73	504	8.64
OPTO	LED LAMPS	130	156	156	161	190	233	277	327	389	16.48	756	14.21
	LED DISPLAYS	294	332	327	346	399	459	514	616	714	13.93	1204	11.02
	OPTO COUPLERS	103	110	110	115	130	162	196	239	284	17.16	579	15.31
	OTHER	167	189	167	181	203	233	271	308	362	13.79	668	13.04
TOTAL	I.C.	9787	9640	10421	12331	15753	20358	25840	31952	38828	24.57	113344	23.89
	DISCRETE	3656	3832	3435	3612	3937	4386	4833	5339	5876	9.30	8820	8.46
	OPTO	694	787	760	883	922	1087	1258	1490	1749	14.93	3207	12.89
	SEMICONDUCTOR	14137	14259	14616	16746	20612	25831	31931	38781	46453	21.30	125371	21.97

*Columns may not add due to rounding

Note: Please see Introduction to Appendix A for discussion of terms and definitions. Exchange rates are given in Table A-0 at the end of the Introduction.

Source: DATAQUEST

Table A-16

NORTH AMERICAN SEMICONDUCTOR CONSUMPTION FORECAST*
(Millions of Dollars)
1980 through 1988, plus 1993

		1980	1981	1982	1983	1984	1985	1986	1987	1988	(82-88) CAG %	1993	(88-93) CAG %
INTEGRATED CIRCUIT	BIPOLAR DIGITAL	1507	1236	1368	1492	1668	1833	1996	2115	2199	8.25	3027	6.60
	TTL												
	DTL												
	ECL												
	OTHER												
	MOS DIGITAL	2512	2455	2785	3310	4532	6426	8654	10838	13022	29.38	38737	24.36
	CMOS												
	NMOS												
	PMOS												
	LINEAR	733	890	897	1081	1356	1687	2062	2499	2950	22.00	6960	18.73
DISCRETE	TRANSISTOR	516	574	484	491	551	629	715	790	865	10.18	1186	6.52
	SMALL SIGNAL	234	269	218	222	245	274	299	320	339	7.65	423	4.53
	POWER	282	305	266	269	306	355	416	470	526	12.06	763	7.72
	DIODE	391	395	369	393	433	489	552	607	653	10.00	965	8.12
	SMALL SIGNAL	63	72	70	73	79	88	96	104	113	8.33	148	5.54
	POWER	246	242	220	238	266	303	349	387	418	11.31	648	9.16
	SENSR	82	81	79	82	88	98	107	116	122	7.53	169	6.73
	THYRISTOR	120	121	108	116	132	151	170	188	205	11.30	318	9.18
	OTHER	46	45	53	57	65	74	83	92	101	11.37	156	9.08
OPTO	LED LAMPS	38	29	37	39	45	54	65	77	89	15.79	164	13.00
	LED DISPLAYS	96	95	88	93	107	120	134	174	198	14.50	374	13.56
	OPTO COUPLERS	54	56	54	57	64	75	93	110	124	14.89	240	14.12
	OTHER	60	61	54	57	63	72	91	105	122	14.58	226	13.12
TOTAL	I.C.	4752	4581	5050	5883	7556	9946	12712	15452	18171	23.84	48724	21.81
	DISCRETE	1081	1135	1014	1057	1181	1343	1520	1677	1824	10.30	2625	7.55
	OPTO	240	241	233	246	279	321	383	466	533	14.82	1004	13.50
	SEMICONDUCTOR	6073	5957	6297	7186	9016	11610	14615	17595	20528	21.82	52353	20.59

*Columns may not add due to rounding

Note: Please see Introduction to Appendix A for discussion of terms and definitions. Exchange rates are given in Table A-0 at the end of the Introduction.

Source: DATAQUEST

Table A-17

JAPANESE SEMICONDUCTOR CONSUMPTION FORECAST*
(Millions of Dollars)
1980 through 1988, plus 1993

		1980	1981	1982	1983	1984	1985	1986	1987	1988	(82-88) CAG %	1993	(88-93) CAG %
INTEGRATED CIRCUIT	BIPOLAR DIGITAL	348	525	527	618	741	867	997	1117	1240	15.36	2045	10.52
	TTL												
	DTL												
	ECL												
	OTHER												
	MOS DIGITAL	1091	1152	1315	1661	2276	3073	4025	5193	6456	30.44	22250	28.08
	CMOS												
	NMOS												
	PMOS												
	LINEAR	795	906	957	1109	1375	1677	2013	2355	2697	18.89	5790	16.54
DISCRETE	TRANSISTOR	469	650	491	503	519	562	583	618	664	5.17	800	3.80
	SMALL SIGNAL	279	392	276	284	295	314	320	334	354	4.24	400	2.47
	POWER	190	266	215	219	224	248	263	284	310	6.30	400	5.23
	DIODE	370	451	346	353	372	393	407	416	435	3.90	510	3.23
	SMALL SIGNAL	111	175	127	129	136	143	147	149	152	3.05	176	2.98
	POWER	219	232	185	189	200	212	221	227	241	4.52	285	3.41
	ZENER	40	44	34	35	36	38	39	40	42	3.59	49	3.13
	THYRISTOR	94	85	74	75	77	80	82	85	88	2.94	102	3.00
	OTHER	61	72	77	79	85	92	96	105	115	6.93	159	6.69
OPTO	LED LAMPS	30	51	46	44	55	69	78	92	118	15.67	221	14.97
	LED DISPLAYS	83	125	116	116	128	141	153	180	212	10.59	348	10.42
	OPTO COUPLERS	16	22	21	21	23	32	36	44	51	15.97	105	15.54
	OTHER	54	80	67	72	79	88	96	106	127	11.27	209	10.48
TOTAL	I.C.	2234	2663	2799	3388	4392	5617	7035	8665	10393	24.49	30093	23.69
	DISCRETE	994	1266	988	1010	1053	1127	1168	1224	1302	4.72	1571	3.83
	OPTO	183	278	250	253	285	330	363	422	500	12.27	883	12.05
	SEMICONDUCTOR	3411	4207	4037	4651	5730	7074	8566	10311	12195	20.28	32547	21.69

*Columns may not add due to rounding

Note: Please see Introduction to Appendix A for discussion of terms and definitions. Exchange rates are given in Table A-0 at the end of the Introduction.

Source: DATAQUEST

Table A-18

WESTERN EUROPEAN SEMICONDUCTOR CONSUMPTION FORECAST*
(Millions of Dollars)
1980 through 1988, plus 1993

		1980	1981	1982	1983	1984	1985	1986	1987	1988	(82-88) CAG %	1993	(88-93) CAG %
INTEGRATED CIRCUIT	BIPOLAR DIGITAL	510	454	434	484	580	665	765	868	963	14.24	1692	11.93
	TTL												
	DTL												
	ECL												
	OTHER												
	MOS DIGITAL	1139	882	948	1123	1423	1822	2350	3045	3963	26.98	14661	29.91
	CMOS												
	NMOS												
	PMOS												
	LINEAR	684	556	606	679	784	931	1110	1341	1627	17.93	3722	18.00
DISCRETE	TRANSISTOR	511	463	468	519	567	620	679	762	851	10.50	1430	10.94
	SMALL SIGNAL	275	251	247	265	281	299	318	349	377	7.32	517	6.52
	POWER	236	212	221	254	286	321	361	413	474	13.59	913	14.01
	DIODE	503	384	391	434	475	520	569	639	715	10.61	1192	10.76
	SMALL SIGNAL	225	157	154	165	175	186	198	216	234	7.24	321	6.53
	POWER	231	192	202	231	258	288	322	367	418	12.91	770	13.00
	ZENER	47	35	35	38	42	46	49	56	63	10.31	101	9.90
	THYRISTOR	133	103	105	117	130	144	159	181	205	11.82	361	11.98
	OTHER	45	45	47	52	57	62	67	75	84	10.18	135	9.95
OPTO	LED LAMPS	41	41	44	48	54	66	81	96	117	17.74	268	18.03
	LED DISPLAYS	58	57	65	77	92	110	122	138	159	16.11	290	12.77
	OPTO COUPLERS	27	27	28	30	34	44	54	70	91	21.75	217	18.98
	OTHER	35	29	31	36	42	50	57	65	75	15.90	161	16.51
TOTAL	I.C.	2333	1892	1988	2286	2707	3418	4225	5254	6553	22.04	20975	25.10
	DISCRETE	1192	995	1011	1122	1229	1346	1474	1657	1855	10.67	3118	10.94
	OPTO	161	154	168	191	222	270	314	369	442	17.53	936	16.19
	SEMICONDUCTOR	3686	3041	3167	3599	4238	5034	6013	7280	8850	18.72	24129	22.21

*Columns may not add due to rounding

Note: Please see Introduction to Appendix A for discussion of terms and definitions. Exchange rates are given in Table A-0 at the end of the Introduction.

Source: DATAQUEST

Table A-19

REST OF WORLD SEMICONDUCTOR CONSUMPTION FORECAST*
(Millions of Dollars)
1980 through 1988, plus 1993

		1980	1981	1982	1983	1984	1985	1986	1987	1988	(82-88) CAG %	1993	(88-93) CAG %
INTEGRATED CIRCUIT	BIPOLAR DIGITAL	85	109	109	113	121	131	139	146	232	13.45	374	10.02
	TTL												
	DTL												
	ECL												
	OTHER												
	MOS DIGITAL	177	102	248	395	575	850	1250	1875	2825	50.12	12575	34.80
	CMOS												
	NMOS												
	PMOS												
	LINEAR	206	213	227	266	322	396	479	560	654	19.33	1503	18.11
DISCRETE	TRANSISTOR	166	212	216	216	240	286	333	383	437	12.49	687	9.47
	SMALL SIGNAL	68	112	103	101	110	128	147	167	189	10.67	262	6.75
	POWER	98	100	113	115	130	158	186	216	248	14.03	425	11.37
	DIODE	164	175	154	154	173	209	248	290	334	13.80	540	10.09
	SMALL SIGNAL	44	65	48	47	52	61	71	81	92	11.48	120	5.46
	POWER	96	80	78	80	91	112	135	161	188	15.83	345	12.91
	ZENER	24	30	28	27	30	36	42	48	54	11.59	75	6.79
	THYRISTOR	35	36	38	39	45	55	66	79	91	15.70	225	19.85
	OTHER	24	13	14	14	16	20	24	29	33	15.40	54	10.35
OPTO	LED LAMPS	29	35	29	30	36	44	53	62	73	16.67	103	7.13
	LED DISPLAYS	57	55	58	60	72	88	105	124	145	16.53	192	5.78
	OPTO COUPLERS	6	5	7	7	9	11	13	15	18	17.08	17	-1.14
	OTHER	18	19	15	16	19	23	27	32	38	16.79	72	13.63
TOTAL	I.C.	468	504	584	774	1018	1377	1868	2581	3711	36.18	14452	31.25
	DISCRETE	389	436	422	423	474	570	671	781	895	13.38	1506	10.97
	OPTO	110	114	109	113	136	166	198	233	274	16.64	384	6.98
	SEMICONDUCTOR	967	1054	1115	1310	1628	2113	2737	3595	4880	27.96	16342	27.34

*Columns may not add due to rounding

Note: Please see Introduction to Appendix A for discussion of terms and definitions. Exchange rates are given in Table A-0 at the end of the Introduction.

Source: DATAQUEST

Table A-20

WORLDWIDE AVERAGE SELLING PRICES FORECAST*
(Dollars)
1980 through 1988, plus 1993

		1980	1981	1982	1983	1984	1985	1986	1987	1988	1993
INTEGRATED CIRCUIT	BIPOLAR DIGITAL	0.70	0.70	0.62	0.65	0.70	0.75	0.80	0.90	0.95	1.00
	TTL										
	DTL										
	ECL										
	OTHER										
	MOS DIGITAL	1.87	1.86	1.85	1.86	1.96	2.25	2.30	2.35	2.45	2.50
	CMOS	0.62	0.64	0.63	0.61	0.75	0.95	1.15	1.25	1.35	1.50
	NMOS	4.40	4.43	4.45	4.40	4.40	4.41	4.41	4.41	4.42	4.44
	PMOS	1.75	1.70	1.70	1.75	1.75	1.75	1.75	1.76	1.76	1.70
	LINEAR	0.83	0.81	0.79	0.80	0.84	0.85	0.87	0.90	0.93	0.95
DISCRETE	TRANSISTOR	0.16	0.15	0.14	0.15	0.16	0.14	0.15	0.13	0.13	0.13
	SMALL SIGNAL	0.09	0.09	0.08	0.09	0.09	0.08	0.08	0.07	0.07	0.06
	POWER	0.60	0.56	0.54	0.56	0.57	0.57	0.56	0.54	0.54	0.51
	DIODE	0.07	0.07	0.07	0.07	0.07	0.06	0.06	0.06	0.06	0.06
	SMALL SIGNAL	0.04	0.04	0.04	0.04	0.04	0.03	0.03	0.03	0.04	0.04
	POWER	0.11	0.10	0.09	0.10	0.10	0.09	0.09	0.08	0.08	0.06
	ZENER	0.14	0.14	0.13	0.13	0.13	0.12	0.12	0.11	0.11	0.12
	THYRISTOR	0.98	1.09	0.95	0.97	0.97	0.96	0.96	0.96	0.95	0.93
	OTHER	0.26	0.26	0.23	0.18	0.18	0.17	0.17	0.16	0.16	0.13
OPTO	LED LAMPS	0.13	0.12	0.12							
	LED DISPLAYS	1.45	1.50	1.30							
	OPTO COUPLERS	0.83	0.77	0.70							
	OTHER	0.90	1.07	1.11							
TOTAL	I.C.	1.08	1.06	1.02	1.07	1.17	1.31	1.40	1.51	1.61	1.85
	DISCRETE	0.12	0.11	0.11	0.11	0.11	0.10	0.10	0.09	0.10	0.09
	OPTO	0.46	0.41	0.39	0.28	0.28	0.27	0.26	0.26	0.26	0.25
	SEMICONDUCTOR	0.34	0.31	0.33	0.36	0.40	0.40	0.45	0.46	0.53	0.75

*Columns may not add due to rounding

Note: Please see Introduction to Appendix A for discussion of terms and definitions. Exchange rates are given in Table A-0 at the end of the Introduction.

Source: DATAQUEST

Table A-21

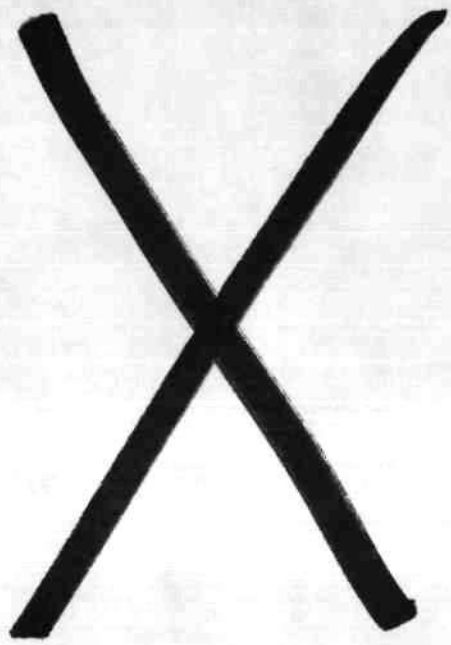
WORLDWIDE SEMICONDUCTOR CONSUMPTION FORECAST*
(Millions of Units)
1980 through 1988, plus 1993

		1980	1981	1982	1983	1984	1985	1986	1987	1988	(82-88) CAG%	1993	(88-93) CAG %
INTEGRATED CIRCUIT	BIPOLAR DIGITAL	3500	3320	3932	4165	4443	4661	4871	4718	4878	3.07	7138	7.91
	TTL												
	DTL												
	ECL												
	OTHER												
	MOS DIGITAL	2630	2511	2863	3489	4493	5409	7078	8915	10721	26.16	35289	26.91
	CMOS												
	NMOS												
	PMOS												
	LINEAR	2913	3265	3401	3919	4560	5519	6510	7506	8525	17.55	18929	17.30
DISCRETE	TRANSISTOR	10696	12955	12059	11219	12004	14586	15739	19275	20871	10.14	31604	8.65
	SMALL SIGNAL	9511	11378	10550	9689	10344	12608	13550	16714	17986	9.04	26700	8.22
	POWER	1185	1577	1509	1530	1660	1898	2189	2561	2885	12.08	4904	11.19
	DIODE	19654	20542	18940	19130	20708	27917	30453	34972	33142	10.35	56542	11.28
	SMALL SIGNAL	11075	11725	9975	10350	11050	15933	17067	18333	14775	7.16	19125	5.30
	POWER	7200	7460	7611	7380	8150	10167	11411	14275	15813	13.73	34133	16.64
	ZENER	1379	1357	1354	1400	1508	1817	1975	2364	2555	11.82	3283	5.15
	THYRISTOR	398	317	342	358	396	448	497	555	620	11.03	1082	11.77
	OTHER	677	673	830	1122	1239	1459	1588	1881	2081	17.55	3877	13.25
OPTO	LED LAMPS	1000	1300	1357									
	LED DISPLAYS	203	221	252									
	OPTO COUPLERS	124	143	156									
	OTHER	186	176	151									
TOTAL	I.C.	9044	9097	10196	11572	13504	15589	18459	21139	24123	16.37	61357	20.53
	DISCRETE	31425	34486	32172	31829	34347	44409	48277	56684	56714	10.49	93104	10.42
	OPTO	1513	1841	1915	2868	3293	4026	4838	5731	6727	24.74	12828	13.78
	SEMICONDUCTOR	41981	45424	44283	46269	51143	64025	71575	83553	87565	12.75	167289	13.82

*Columns may not add due to rounding

Note: Please see Introduction to Appendix A for discussion of terms and definitions. Exchange rates are given in Table A-0 at the end of the Introduction.

Source: DATAQUEST



1983 #2

Consumption and Factory Shipments

INTRODUCTION

Consumption/factory shipments data comprise a set of detailed tables that estimate semiconductor consumption and semiconductor factory shipments both worldwide and for four major geographical regions for the years 1974 through 1989 and 1994. Semiconductor consumption tables are divided into historical data tables and forecast tables. Semiconductor factory shipments tables are historical data tables only. All historical tables begin with 1974 and end with 1983, while all forecast tables begin with 1982 and end with 1989 with an additional 1994 column. Please refer to the "Forecast" section for a discussion of the differences between historical and future dollar values. A list of tables detailing the type of data, region, years and units, is as follows:

LIST OF TABLES--CONSUMPTION/FACTORY SHIPMENTS

Table	Region	Consumption/ Factory Shipments	Years	Units
0	Japan, Western Europe	Exchange Rates	1970-1983	Various
1	Worldwide	Consumption	1974-1983	Dollars
2	Worldwide	Consumption	1982-1989; 1994	Dollars
3	North America	Consumption	1974-1983	Dollars
4	North America	Consumption	1982-1989; 1994	Dollars
5	Japan	Consumption	1974-1983	Dollars
6	Japan	Consumption	1982-1989; 1994	Dollars
7	Japan	Consumption	1974-1983	Yen
8	Japan	Consumption	1982-1989; 1994	Yen
9	Western Europe	Consumption	1974-1983	Dollars
10	Western Europe	Consumption	1982-1989; 1994	Dollars
11	Rest of World	Consumption	1974-1983	Dollars
12	Rest of World	Consumption	1982-1989; 1994	Dollars
13	Worldwide	Average Selling Price	1974-1983	Dollars
14	Worldwide	Average Selling Price	1982-1989; 1994	Dollars
15	Worldwide	Consumption	1974-1983	Units
16	Worldwide	Consumption	1982-1989; 1934	Units
17	Worldwide	Factory Shipments	1974-1983	Dollars
18	North America	Factory Shipments	1974-1983	Dollars
19	Japan	Factory Shipments	1974-1983	Dollars
20	Japan	Factory Shipments	1974-1983	Yen
21	Western Europe	Factory Shipments	1974-1983	Dollars
22	Rest of World	Factory Shipments	1974-1983	Dollars

Consumption and Factory Shipments

Each table gives estimates of semiconductor consumption or factory shipments listed by the major semiconductor device product categories. In these tables, semiconductor components are divided into three major product groups: integrated circuits, discrete devices, and optoelectronic devices. These groups are divided into a number of subgroups, some of which are segmented further.

DEFINITIONS AND CONVENTIONS

DATAQUEST uses a common manufacturer base for all data tables. This base includes all merchant suppliers to the semiconductor market. It excludes captive suppliers that manufacture devices solely for the benefit of the parent company, such as Burroughs, IBM, and Western Electric. Included, however, are companies that actively market semiconductor devices to the merchant market as well as to other divisions of their own companies. A recent case in point is NCR, previously a captive supplier, which in 1982 offered products on the merchant market for the first time. For such companies, both external shipments and internal consumption are included. Devices that are used internally are valued at current market prices.

Consumption--DATAQUEST defines consumption as the purchase of a semiconductor device or devices. This definition must be differentiated from actual use of the device in a final product. Devices that are inventoried at the user level are considered consumption according to our definition.

Factory Shipments Location--The fabrication and assembly of a semiconductor device may be performed in several different locations. Factory shipment is defined as occurring from that point where the device was tested and marked, irrespective of where the device was assembled or where the initial wafer fabrication was performed.

Hybrids--In earlier consumption/factory shipment data, hybrid devices were included as a separate segment of integrated circuits. However, since hybrid devices are primarily a special packaging arrangement, this segment has been omitted. Hybrid devices manufactured by semiconductor companies are now included in the most appropriate product segment, usually the linear segment.

Power Devices--The difference between low-power and high-power transistors is set at the 1-watt power-handling capability. Power diodes are rated at 1 amp or higher; small-signal diodes are rated at less than 1 amp. Special discrete devices that are neither transistors, diodes, nor thyristors are categorized as "other discretes."

The manufacturer base product group definitions and guidelines for including value of output that we have used in our tables may differ from those used in other studies of this type. Our base is nearly the same as that used by the Semiconductor Industry Association (SIA).

Regions--North America is defined as including both the United States and Canada. Latin America, including Mexico, is considered part of the Rest of World (ROW) category. Western Europe includes Austria, Belgium, the Federal Republic of Germany, France, Greece, Italy, Luxembourg, the Scandinavian countries (Denmark, Finland, Norway, Sweden), Spain, and the United Kingdom.

DATA SOURCES

The information presented in the consumption/factory shipment data is a consolidation from a variety of fragmentary sources, each of which focuses on a specific part of the market. These sources include the following:

- U.S. Commerce Department trade statistics and Semiconductor Trade Statistics Program (STSP) marketing data are used in determining North American consumption and factory shipments.
- Japanese trade statistics, compiled and published by the Ministry of Finance and the Ministry of International Trade and Industry (MITI), are used to determine Japanese factory shipments and consumption in yen. The STSP also details semiconductor sales of U.S. and Western European manufacturers to Japan.
- For West European markets, U.S. Department of Commerce trade statistics, marketing statistics, from the Semiconductor Industry Association (SIA), and shipment estimates for each company are the primary data sources used.
- U.S. Commerce Department trade statistics, STSP data, and MITI trade statistics constitute the major published sources used to estimate ROW consumption and factory shipments.

Consumption and Factory Shipments

DATAQUEST believes that the estimates presented here are the most accurate and meaningful generally available today. The sources of the data and the guidelines for the forecasts presented in the tables are:

- Unit sales or revenues (or both) published by major industry participants, both in the United States and abroad
- Estimates presented by knowledgeable and reliable industry spokesmen
- Government data or trade association data such as those from the Electronics Industry Association (EIA), MITI, SIA, and the U.S. Department of Commerce
- Published product literature and price lists
- Interviews with knowledgeable manufacturers, distributors, and users
- Relevant projected world economic data

CONSISTENCY

One of the key objectives in preparing these estimates is to achieve consistency among the various data elements that constitute the forecast and the historical data base. To ensure the accuracy and consistency of the estimates, we have compared the value of directly obtained data elements with values obtained by indirect means, wherever possible. Thus, the worldwide totals in the consumption/factory shipment analysis are consistent with the worldwide totals of the market share analysis. However, the regional factory shipments totals of the market share data do not and should not equal the regional factory shipments totals of the consumption/factory shipment tables because this analysis includes factories of all national origins producing in Japan. This would include companies like Texas Instruments Japan.

ACCURACY

The tables presented here represent DATAQUEST estimates that we believe are reasonably accurate. Where we have no reasonable estimate, none is given. A blank space in a table indicates that a reasonably accurate estimate is unavailable, and a zero in a table represents an estimate.

Consumption and Factory Shipments

VALUATION OF CONSUMPTION AND FACTORY SHIPMENTS

Regional consumption and factory shipments are all expressed in U.S. dollars, (Japanese consumption and shipments are also expressed in yen). To make the tables in this study useful in comparing different regions, it is necessary to express all values in a common currency and, because of the U.S. producers' large presence in international markets, the dollar is the preferred choice.

However, the choice of the U.S. dollar (or any single currency, for that matter) as the currency basis for the tables, brings with it some problems that require the readers' careful consideration in interpreting the data.

Inflation

All countries that participate significantly in international semiconductor markets suffered from an overall price inflation in the 1970s, continuing into the 1980s.

As a consequence, the dollar in a given year is not truly comparable with the dollar in any preceding year. Consumer and wholesale price indices and GNP deflators all measure price changes in various composite "market baskets" of goods. However, there is no price index that measures price changes of material, equipment, and labor inputs to the semiconductor industry. Indeed, the "mix" is changing so rapidly that what is used this year was sometimes unavailable last year, at any price. Nor is there a composite price index that measures price changes in aggregate semiconductor product. In an industry noted for its deflationary trends, this latter effect would tend to make the component purchaser's dollar worth more as time passed, in terms of electronic purchasing ability.

We have made no adjustments in the historical data to account for these inflationary and deflationary effects. The data are expressed in current dollars (dollars that include the inflation rate and exchange rates of the given year) for all historical data; comparisons between different years must be interpreted accordingly.

Average Selling Prices

When considering the worldwide average selling prices (ASPs) for semiconductor components, one must look at the price per function of a circuit, the complexity of the circuit, and the product mix according to this increasing complexity. It is true that one characteristic of the

semiconductor industry is that the price per function for integrated circuits has been dropping an average of 30 percent per year for the last decade. At the same time, circuits have become denser, resulting in an overall increase in the price of a device with a decreasing cost per function. Thus, Table 14 shows the worldwide ASPs increasing after many years of decreasing, due to the move toward higher-complexity devices. There are also regional differences in ASPs due to regional competition differences and the varying regional product consumption mix. The worldwide ASP is truly an aggregate measure and may differ significantly from ASPs in any specific market at any point in time.

Exchange Rates

Construction of the West European tables involves combining data from many countries, each of which has different and changing exchange rates. DATAQUEST uses International Monetary Fund average foreign exchange rates for each year, and, as far as possible, we prepare our estimates in terms of local currencies before conversion to U.S. dollars. The exchange rates for major currencies can be found in Table 0 at the end of this introduction.

Japanese consumption and factory shipments are based on MITI data, which are originally expressed in yen. The Japanese data published in this study are expressed in both dollars (Tables 5, 6, and 19) and in yen (Tables 7, 8, and 20). The yen/dollar exchange rate used for each year can be found in Table 0. Because of the fluctuations in the exchange rate for the yen, the dollar values given tend to distort the growth rate of the Japanese market, but they do provide a useful basis for regional market size comparisons. However, the data in yen give a better picture of the real growth in the Japanese market.

FORECAST

As mentioned previously, historical data are expressed in current dollars or dollars that include the given year's inflation rate and exchange rates. However, the consumption forecasts, which appear in Tables 2, 4, 6, 8, 10, and 12, use constant dollars and exchange rates, with no allowance for inflation or variations in the rates of exchange between countries. All estimates for 1983 and beyond are made as if 1983 monetary conditions will continue through 1994 and, therefore, show the absolute year-to-year growth during this period.

Information on interregional trade and other analyses used in the preparation of these tables is available to DATAQUEST clients upon request.

Table 0

ANNUAL FOREIGN EXCHANGE RATES
(Expressed in U.S. Dollars)

Year	Japan (Dollars per Yen)	France (Dollars per French Franc)	West Germany (Dollars per Deutsche Mark)	United Kingdom (Dollars per Pound Sterling)
1970	$0.002795	$0.1810	$0.2744	$2.3963
1971	$0.002913	$0.1822	$0.2886	$2.4506
1972	$0.003311	$0.1985	$0.3140	$2.4878
1973	$0.003721	$0.2267	$0.3811	$2.4587
1974	$0.003427	$0.2099	$0.3897	$2.3524
1975	$0.003368	$0.2337	$0.4063	$2.2069
1976	$0.003376	$0.2091	$0.3998	$1.7960
1977	$0.003761	$0.2042	$0.4337	$1.7602
1978	$0.004857	$0.2251	$0.5051	$1.9310
1979	$0.004518	$0.2361	$0.5482	$2.1312
1980	$0.004449	$0.2335	$0.5463	$2.3241
1981	$0.004519	$0.1839	$0.4429	$1.8741
1982	$0.004022	$0.1523	$0.4123	$1.7418
1983*	$0.004255	$0.1304	$0.3894	$1.5120

*DATAQUEST estimates

Source: The Wall Street Journal
DATAQUEST

TABLE 1

HISTORICAL WORLDWIDE SEMICONDUCTOR CONSUMPTION
(Millions of Dollars)
1974 through 1983

	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	CAG % (74-83)
Total Semiconductor	5,405	4,373	5,827	6,916	8,868	11,088	14,056	14,334	14,832	18,685	14.8
Total Integrated Circuit	2,510	2,120	2,941	3,770	5,268	7,077	9,659	9,788	10,711	14,133	21.2
Bipolar Digital (Technology)	979	682	865	1,060	1,320	1,690	2,409	2,362	2,425	3,043	13.4
TTL	719	499	682	852	1,046	1,375	2,076	2,004	2,058	2,623	15.5
DTL	105	81	71	61	56	52	45	43	40	40	(10.2)
ECL	73	55	76	100	140	170	189	220	235	290	16.6
Other Bipolar Digital	82	47	36	47	78	93	99	95	92	90	1.0
Bipolar Digital (Function)	979	682	865	1,060	1,320	1,690	2,409	2,362	2,425	3,043	13.4
Bipolar Digital Memory						326	556	553	508	601	
Bipolar Digital Logic						1,364	1,853	1,809	1,917	2,442	
MOS (Technology)	880	837	1,239	1,613	2,398	3,460	4,890	4,749	5,546	7,694	27.2
NMOS	72	133	377	716	1,477	2,364	3,469	3,188	3,891	5,372	61.5
PMOS	697	609	658	613	574	557	473	387	330	322	(8.2)
CMOS	111	95	204	284	347	539	948	1,174	1,325	2,000	37.9
MOS (Function)	880	837	1,239	1,613	2,398	3,460	4,890	4,749	5,546	7,694	27.2
MOS Memory						1,672	2,263	2,041	2,675	3,669	
MOS Microprocessor						570	892	1,070	1,272	1,919	
MOS Logic						1,218	1,735	1,638	1,599	2,106	
Linear	651	601	837	1,097	1,550	1,927	2,360	2,677	2,740	3,396	20.1
Total Discrete	2,700	2,028	2,598	2,840	3,184	3,407	3,673	3,763	3,315	3,549	3.1
Transistor	1,400	1,063	1,333	1,429	1,535	1,658	1,766	1,905	1,660	1,813	2.9
Small Signal Transistor	874	638	793	799	844	870	897	1,025	865	938	0.8
Power Transistor	526	425	540	630	691	788	869	880	795	875	5.8
Diode	944	709	911	997	1,184	1,219	1,346	1,324	1,173	1,240	3.1
Small Signal Diode	323	211	286	309	362	420	450	432	383	387	2.0
Power Diode	482	398	504	559	657	653	728	723	623	690	4.1
Zener Diode	139	100	121	129	165	146	168	169	167	163	1.8
Thyristor	232	180	241	293	317	360	392	352	308	314	3.4
Other Discrete	124	76	113	121	148	170	169	182	174	182	4.4
Total Optoelectronic	195	225	288	306	416	604	724	783	806	1,003	20.0
LED Lamps	23	32	54	65	89	124	148	178	192	246	30.1
LED Displays	120	128	151	144	193	255	291	292	295	357	12.9
Optical Couplers	21	22	29	33	50	86	104	114	123	154	24.8
Other Optoelectronics	31	43	54	64	84	139	181	199	196	246	25.9

Source: DATAQUEST

TABLE 2

WORLDWIDE SEMICONDUCTOR CONSUMPTION FORECAST
(Millions of Dollars)
1982 through 1989, plus 1994

	1982	1983	1984	1985	1986	1987	1988	1989	CAG % (83-89)	1994	CAG % (89-94)
Total Semiconductor	14,832	18,685	25,767	32,856	37,283	41,149	49,990	63,971	22.8	175,479	22.4
Total Integrated Circuit	10,711	14,133	20,294	26,634	30,814	34,389	42,481	55,437	25.6	160,381	23.7
Bipolar Digital (Technology)	2,425	3,043	4,147	5,069	5,565	5,562	6,514	7,808	17.0	14,386	13.0
TTL	2,058	2,623									
DTL	40	40									
ECL	235	290									
Other Bipolar Digital	92	90									
Bipolar Digital (Function)	2,425	3,043	4,147	5,069	5,565	5,562	6,514	7,808	17.0	14,386	13.0
Bipolar Digital Memory	508	601	806	973	1,078	1,121	1,263	1,462	16.0	2,472	11.1
Bipolar Digital Logic	1,917	2,442	3,341	4,096	4,487	4,441	5,251	6,346	17.3	11,914	13.4
MOS (Technology)	5,546	7,694	11,984	16,484	19,562	22,512	28,888	39,201	31.2	129,168	26.9
NMOS	3,891	5,372	8,629	11,383	11,795	10,706	11,839	15,496	19.3	23,444	8.6
PMOS	330	322	300	275	255	215	155	150	(12.0)	145	(0.7)
CMOS	1,325	2,000	3,055	4,826	7,512	11,591	16,894	23,555	50.8	105,579	35.0
MOS (Function)	5,546	7,694	11,984	16,484	19,562	22,512	28,888	39,201	31.2	129,168	26.9
MOS Memory	2,675	3,669	6,215	8,535	9,855	10,432	13,009	17,885	30.2	60,515	27.6
MOS Microprocessor	1,272	1,919	2,874	4,056	5,079	6,313	8,513	11,876	35.5	43,362	29.6
MOS Logic	1,599	2,106	2,895	3,893	4,628	5,767	7,366	9,440	28.4	25,291	21.8
Linear	2,740	3,396	4,163	5,081	5,687	6,315	7,079	8,428	16.4	16,827	14.8
Total Discrete	3,315	3,549	4,216	4,721	4,832	4,906	5,279	5,770	8.4	7,857	6.4
Transistor	1,660	1,813	2,181	2,457	2,499	2,581	2,847	3,177	9.8	4,467	7.1
Small Signal Transistor	865	938	1,080	1,167	1,150	1,201	1,300	1,404	7.0	1,681	3.7
Power Transistor	795	875	1,101	1,290	1,349	1,380	1,547	1,773	12.5	2,786	9.5
Diode	1,173	1,240	1,442	1,604	1,647	1,631	1,689	1,782	6.2	2,229	4.6
Small Signal Diode	383	387	432	462	461	450	450	470	3.3	524	2.2
Power Diode	623	690	814	923	955	949	991	1,047	7.2	1,370	5.5
Zener Diode	167	163	196	219	231	232	248	265	8.4	335	4.8
Thyristor	308	314	363	395	404	402	424	451	6.2	577	5.1
Other Discrete	174	182	230	265	282	292	319	360	12.0	584	10.2
Total Optoelectronic	806	1,003	1,257	1,501	1,637	1,854	2,230	2,764	18.4	7,241	21.2
LED Lamps	192	246	278	299	325	324	378	460	11.0	1,099	19.0
LED Displays	295	357	441	517	550	575	673	770	13.7	1,771	18.1
Optical Couplers	123	154	190	251	290	349	441	563	24.1	1,587	23.0
Other Optoelectronics	196	246	348	434	472	606	738	971	25.7	2,784	23.4

Source: DATAQUEST

TABLE 3

HISTORICAL NORTH AMERICAN SEMICONDUCTOR CONSUMPTION
(Millions of Dollars)
1974 through 1983

	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	CAG % (74-83)
Total Semiconductor	2,264	1,810	2,351	2,742	3,429	4,619	6,067	6,085	6,551	8,286	15.5
Total Integrated Circuit	1,259	1,018	1,418	1,795	2,357	3,311	4,744	4,866	5,268	6,909	20.8
Bipolar Digital (Technology)	573	362	488	593	721	922	1,443	1,322	1,342	1,716	13.0
TTL											
DTL											
ECL											
Other Bipolar Digital											
Bipolar Digital (Function)	573	362	488	593	721	922	1,443	1,322	1,342	1,716	13.0
Bipolar Digital Memory						207	393	382	315	381	
Bipolar Digital Logic						715	1,050	940	1,027	1,335	
MOS (Technology)	442	432	669	845	1,151	1,825	2,593	2,532	3,078	4,085	28.0
NMOS											
PMOS											
CMOS											
MOS (Function)	442	432	669	845	1,151	1,825	2,593	2,532	3,078	4,085	28.0
MOS Memory						1,027	1,239	1,064	1,497	1,932	
MOS Microprocessor						315	533	636	710	1,048	
MOS Logic						483	821	832	871	1,105	
Linear	244	224	270	357	485	564	708	812	848	1,108	18.3
Total Discrete	884	664	789	832	916	1,067	1,073	1,141	998	1,049	1.9
Transistor	431	339	400	405	451	521	516	574	483	489	1.4
Small Signal Transistor	240	179	208	194	219	241	234	269	218	220	(1.0)
Power Transistor	191	160	192	211	232	280	282	305	265	269	3.9
Diode	297	223	265	291	314	368	385	395	359	393	3.2
Small Signal Diode	94	52	65	60	55	61	63	72	68	73	(2.8)
Power Diode	149	128	153	174	182	235	246	242	203	238	5.3
Zener Diode	54	43	47	57	77	72	76	81	88	82	4.8
Thyristor	81	60	83	100	106	130	129	125	101	109	3.4
Other Discrete	75	42	41	36	45	48	43	47	55	58	(2.8)
Total Optoelectronic	121	128	144	115	156	241	250	278	285	328	11.7
LED Lamps	12	13	15	15	20	34	34	46	48	61	19.8
LED Displays	83	86	90	59	85	97	92	90	89	98	1.9
Optical Couplers	13	13	17	17	21	48	53	64	66	79	22.2
Other Optoelectronics	13	16	22	24	30	62	71	78	82	90	24.0

Source: DATAQUEST

TABLE 4

NORTH AMERICAN SEMICONDUCTOR CONSUMPTION FORECAST
(Millions of Dollars)
1982 through 1989, plus 1994

	1982	1983	1984	1985	1986	1987	1988	1989	CAG % (83-89)	1994	CAG % (89-94)
Total Semiconductor	6,551	8,286	12,008	15,562	17,731	19,038	22,805	28,666	23.0	79,344	22.6
Total Integrated Circuit	5,268	6,909	10,278	13,542	15,513	16,710	20,205	25,706	24.5	74,339	23.7
Bipolar Digital (Technology)	1,342	1,716	2,385	2,826	3,021	2,909	3,346	3,880	14.6	6,648	11.4
TTL											
DTL											
ECL											
Other Bipolar Digital											
Bipolar Digital (Function)	1,342	1,716	2,385	2,826	3,021	2,909	3,346	3,880	14.6	6,648	11.4
Bipolar Digital Memory	315	381	503	589	646	660	704	773	12.5	1,099	7.3
Bipolar Digital Logic	1,027	1,335	1,882	2,237	2,375	2,249	2,642	3,107	15.1	5,549	12.3
MOS (Technology)	3,078	4,085	6,520	8,923	10,364	11,321	14,242	18,856	29.0	61,317	26.6
NMOS											
PMOS											
CMOS											
MOS (Function)	3,078	4,085	6,520	8,923	10,364	11,321	14,242	18,856	29.0	61,317	26.6
MOS Memory	1,497	1,932	3,573	4,991	5,512	5,577	6,758	8,998	29.2	29,728	27.0
MOS Microprocessor	710	1,048	1,469	2,037	2,537	3,091	4,183	5,687	32.6	20,316	29.0
MOS Logic	871	1,105	1,478	1,895	2,315	2,653	3,301	4,171	24.8	11,273	22.0
Linear	848	1,108	1,373	1,793	2,128	2,480	2,617	2,970	17.9	6,374	16.5
Total Discrete	998	1,049	1,353	1,578	1,703	1,755	1,895	2,080	12.1	2,836	6.4
Transistor	483	489	635	748	812	858	949	1,085	14.2	1,466	6.2
Small Signal Transistor	218	220	283	326	357	383	411	449	12.6	554	4.3
Power Transistor	265	269	352	422	455	475	538	636	15.4	912	7.5
Diode	359	393	499	582	626	630	661	684	9.7	915	6.0
Small Signal Diode	68	73	91	105	114	116	120	128	9.8	174	6.3
Power Diode	203	238	307	361	388	387	406	416	9.8	562	6.2
Zener Diode	88	82	101	116	124	127	135	140	9.3	179	5.0
Thyristor	101	109	137	150	156	156	161	170	7.7	217	5.0
Other Discrete	55	58	82	98	109	111	124	141	16.0	238	11.0
Total Optoelectronic	285	328	377	442	515	573	705	880	17.9	2,169	19.8
LED Lamps	48	61	77	93	112	106	132	163	17.8	378	18.3
LED Displays	89	98	113	130	148	148	177	197	12.3	371	13.5
Optical Couplers	66	79	86	102	115	145	187	230	19.5	597	21.0
Other Optoelectronics	82	90	101	117	140	174	209	290	21.5	823	23.2

Source: DATAQUEST

TABLE 5

HISTORICAL JAPANESE SEMICONDUCTOR CONSUMPTION
(Millions of Dollars)
1974 through 1983

	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	CAG % (74-83)
Total Semiconductor	1,314	1,005	1,549	1,850	2,500	2,661	3,307	4,245	4,072	5,568	17.4
Total Integrated Circuit	551	451	713	887	1,415	1,655	2,132	2,736	2,870	3,972	24.5
Bipolar Digital (Technology)	135	101	156	200	263	299	348	480	536	682	19.7
TTL											
DTL											
ECL											
Other Bipolar Digital											
Bipolar Digital (Function)	135	101	156	200	263	299	348	480	536	682	19.7
Bipolar Digital Memory						32	44	65	89	109	
Bipolar Digital Logic						267	304	415	447	573	
MOS (Technology)	248	203	286	328	602	754	1,015	1,164	1,272	1,932	25.6
NMOS											
PMOS											
CMOS											
MOS (Function)	248	203	286	328	602	754	1,015	1,164	1,272	1,932	25.6
MOS Memory						253	447	500	603	962	
MOS Microprocessor						113	143	242	331	520	
MOS Logic						388	425	422	338	450	
Linear	168	147	271	359	550	602	769	1,092	1,062	1,358	26.1
Total Discrete	731	519	787	882	978	868	992	1,272	961	1,232	6.0
Transistor	424	311	441	483	498	426	469	658	500	676	5.3
Small Signal Transistor	302	189	293	308	308	260	279	392	250	335	1.2
Power Transistor	122	122	148	175	190	166	190	266	250	341	12.1
Diode	248	168	266	279	353	313	370	451	360	445	6.7
Small Signal Diode	97	71	86	83	97	84	111	175	149	181	7.2
Power Diode	125	79	156	171	225	198	219	232	180	227	6.9
Zener Diode	26	18	24	25	31	31	40	44	31	37	4.0
Thyristor	39	29	51	73	75	76	95	87	69	76	7.7
Other Discrete	20	11	29	47	52	53	58	76	32	35	6.4
Total Optoelectronic	32	35	49	81	107	138	183	237	241	364	31.0
LED Lamps	4	5	9	8	16	20	30	52	67	102	43.3
LED Displays	16	16	27	44	49	62	83	99	93	140	27.3
Optical Couplers	3	3	4	7	11	13	16	17	21	32	30.1
Other Optoelectronics	9	11	9	22	31	43	54	69	60	90	29.2

Source: DATAQUEST

TABLE 6

JAPANESE SEMICONDUCTOR CONSUMPTION FORECAST
(Millions of Dollars)
1982 through 1989, plus 1994

	1982	1983	1984	1985	1986	1987	1988	1989	CAG % (83-89)	1994	CAG % (89-94)
Total Semiconductor	4,072	5,568	7,517	9,426	10,431	12,480	15,508	20,427	24.2	57,986	23.2
Total Integrated Circuit	2,870	3,972	5,572	7,188	8,261	10,182	13,008	17,567	28.1	52,315	24.4
Bipolar Digital (Technology)	536	682	919	1,149	1,264	1,337	1,600	2,000	19.6	3,749	13.4
TTL											
DTL											
ECL											
Other Bipolar Digital											
Bipolar Digital (Function)	536	682	919	1,149	1,264	1,337	1,600	2,000	19.6	3,749	13.4
Bipolar Digital Memory	89	109	154	193	210	225	276	350	21.5	668	13.8
Bipolar Digital Logic	447	573	765	956	1,054	1,112	1,324	1,650	19.3	3,081	13.3
MOS (Technology)	1,272	1,932	2,971	4,037	4,875	6,469	8,651	12,204	36.0	42,067	28.1
NMOS											
PMOS											
CMOS											
MOS (Function)	1,272	1,932	2,971	4,037	4,875	6,469	8,651	12,204	36.0	42,067	28.1
MOS Memory	603	962	1,513	2,008	2,506	2,915	3,801	5,612	34.2	21,162	30.4
MOS Microprocessor	331	520	860	1,204	1,505	2,034	2,771	3,988	40.4	15,075	30.5
MOS Logic	338	450	598	825	864	1,520	2,079	2,604	34.0	5,830	17.5
Linear	1,062	1,358	1,682	2,002	2,122	2,376	2,757	3,363	16.3	6,499	14.1
Total Discrete	961	1,232	1,438	1,617	1,531	1,574	1,653	1,801	6.5	2,589	7.5
Transistor	500	676	812	919	860	904	982	1,084	8.2	1,670	9.0
Small Signal Transistor	250	335	362	381	320	350	369	391	2.6	449	2.8
Power Transistor	250	341	450	538	540	554	613	693	12.5	1,221	12.0
Diode	360	445	496	547	524	516	509	540	3.3	646	3.6
Small Signal Diode	149	181	199	211	198	195	188	195	1.2	211	1.6
Power Diode	180	227	256	291	280	277	273	290	4.2	360	4.4
Zener Diode	31	37	41	45	46	44	48	55	6.8	75	6.4
Thyristor	69	76	84	93	88	91	93	98	4.3	121	4.3
Other Discrete	32	35	46	58	59	63	69	79	14.5	152	14.0
Total Optoelectronic	241	364	507	621	639	724	847	1,059	19.5	3,082	23.8
LED Lamps	67	102	110	105	106	104	115	134	4.7	370	22.5
LED Displays	93	140	186	221	225	236	271	323	15.0	920	23.3
Optical Couplers	21	32	47	74	85	94	116	151	29.5	450	24.4
Other Optoelectronics	60	90	164	221	223	290	345	451	30.8	1,342	24.4

Source: DATAQUEST

TABLE 7

HISTORICAL JAPANESE SEMICONDUCTOR CONSUMPTION
(Billions of Yen)
1974 through 1983

	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	CAG % (74-83)
Total Semiconductor	383.7	298.5	458.5	497.6	525.0	582.8	750.7	938.1	1,009.9	1,308.4	14.6
Total Integrated Circuit	160.9	133.9	211.0	238.6	297.1	362.4	484.0	604.7	711.8	933.4	21.6
Bipolar Digital (Technology)	39.4	30.0	46.2	53.8	55.2	65.5	79.0	106.1	132.9	160.3	16.9
TTL											
DTL											
ECL											
Other Bipolar Digital											
Bipolar Digital (Function)	39.4	30.0	46.2	53.8	55.2	65.5	79.0	106.1	132.9	160.3	16.9
Bipolar Digital Memory						7.0	10.0	14.4	22.1	25.6	
Bipolar Digital Logic						58.5	69.0	91.7	110.9	134.7	
MOS (Technology)	72.4	60.3	84.7	88.2	126.4	165.1	230.4	257.2	315.5	454.0	22.6
NMOS											
PMOS											
CMOS											
MOS (Function)	72.4	60.3	84.7	88.2	126.4	165.1	230.4	257.2	315.5	454.0	22.6
MOS Memory						55.4	101.5	110.5	149.5	226.1	
MOS Microprocessor						24.7	32.5	53.5	82.1	122.2	
MOS Logic						85.0	96.5	93.3	83.8	105.8	
Linear	49.1	43.7	80.2	96.6	115.5	131.8	174.6	241.3	263.4	319.1	23.1
Total Discrete	213.5	154.1	233.0	237.3	205.4	190.1	225.2	281.1	238.3	289.5	3.4
Transistor	123.8	92.4	130.5	129.9	104.6	93.3	106.5	145.4	124.0	156.9	2.8
Small Signal Transistor	88.2	56.1	86.7	82.9	64.7	56.9	63.3	86.6	62.0	78.7	(1.3)
Power Transistor	35.6	36.2	43.8	47.1	39.9	36.4	43.1	58.8	62.0	80.1	9.4
Diode	72.4	49.9	78.7	75.1	74.1	68.5	84.0	99.7	89.3	104.6	4.2
Small Signal Diode	28.3	21.1	25.5	22.3	20.4	18.4	25.2	38.7	37.0	42.5	4.6
Power Diode	36.5	23.5	46.2	46.0	47.3	43.4	49.7	51.3	44.6	53.3	4.3
Zener Diode	7.6	5.3	7.1	6.7	6.5	6.8	9.1	9.7	7.7	8.7	1.5
Thyristor	11.4	8.6	15.1	19.6	15.8	16.6	21.6	19.2	17.1	17.9	5.1
Other Discrete	5.8	3.3	8.6	12.6	10.9	11.6	13.2	16.8	7.9	8.2	3.9
Total Optoelectronic	9.3	10.4	14.5	21.8	22.5	30.2	41.5	52.4	59.8	85.5	27.9
LED Lamps	1.2	1.5	2.7	2.2	3.4	4.4	6.8	11.5	16.6	24.0	39.9
LED Displays	4.7	4.8	8.0	11.8	10.3	13.6	18.8	21.9	23.1	32.9	24.2
Optical Couplers	0.9	0.9	1.2	1.9	2.3	2.8	3.6	3.8	5.2	7.5	27.0
Other Optoelectronics	2.6	3.3	2.7	5.9	6.5	9.4	12.3	15.2	14.9	21.1	26.1
Exchange Rate (Yen/US$)	292.0	297.0	296.0	269.0	210.0	219.0	227.0	221.0	248.0	235.0	

Source: DATAQUEST

TABLE 8

JAPANESE SEMICONDUCTOR CONSUMPTION FORECAST
(Billions of Yen)
1982 through 1989, plus 1994

	1982	1983	1984	1985	1986	1987	1988	1989	CAG % (83-89)	1994	CAG % (89-94)
Total Semiconductor	1,009.9	1,308.4	1,766.5	2,215 1	2,451.3	2,932.8	3,644.4	4,800.3	24.2	13,626.7	23.2
Total Integrated Circuit	711.8	933.4	1,309.4	1,689.2	1,941.3	2,392.8	3,056.9	4,128.2	28.1	12,294.0	24.4
Bipolar Digital (Technology)	132.9	160.3	216.0	270.0	297.0	314.2	376.0	470.0	19.6	881.0	13.4
TTL											
DTL											
ECL											
Other Bipolar Digital											
Bipolar Digital (Function)	132.9	160.3	216.0	270.0	297.0	314.2	376.0	470.0	19.6	881.0	13.4
Bipolar Digital Memory	22.1	25.6	36.2	45.4	49.3	52.9	64.9	82.3	21.5	157.0	13.8
Bipolar Digital Logic	110.9	134.7	179.8	224.7	247.7	261.3	311.1	387.8	19.3	724.0	13.3
MOS (Technology)	315.5	454.0	698 2	948.7	1,145.6	1,520.2	2,033.0	2,867.9	36.0	9,885.7	28.1
NMOS											
PMOS											
CMOS											
MOS (Function)	315.5	454.0	698.2	948.7	1,145.6	1,520.2	2,033.0	2,867.9	36.0	9,885.7	28.1
MOS Memory	149.5	226.1	355.6	471.9	588.9	685.0	893.2	1,318.8	34.2	4,973.1	30.4
MOS Microprocessor	82.1	122.2	202.1	282.9	353.7	478.0	651.2	937.2	40.4	3,542.6	30.5
MOS Logic	83.8	105.8	140.5	193.9	203.0	357.2	488.6	611.9	34.0	1,370.1	17.5
Linear	263.4	319.1	395.3	470.5	498.7	558.4	647.9	790.3	16.3	1,527.3	14.1
Total Discrete	238.3	289.5	337.9	380.0	359.8	369.9	388.5	423.2	6.5	606.4	7.5
Transistor	124.0	158.9	190.8	216.0	202.1	212.4	230.8	254.7	8.2	392.5	9.0
Small Signal Transistor	62.0	78.7	85.1	89.5	75.2	82.3	86.7	91.9	2.6	105.5	2.8
Power Transistor	62.0	80.1	105.8	126.4	126.9	130.2	144.1	162.9	12.5	286.9	12.0
Diode	89.3	104.6	116.6	128.5	123.1	121.3	119.6	126.9	3.3	151.8	3.6
Small Signal Diode	37.0	42.5	46.8	49.6	46.5	45.8	44.2	45.8	1.2	49.6	1.6
Power Diode	44.6	53.3	60.2	68.4	65.8	65.1	64.2	68.2	4.2	84.6	4.4
Zener Diode	7.7	8.7	9.6	10.6	10.8	10.3	11.3	12.9	6.8	17.6	6.4
Thyristor	17.1	17.9	19.7	21.9	20.7	21.4	21.9	23.0	4.3	28.4	4.3
Other Discrete	7.9	8.2	10.8	13.6	13.9	14.8	16.2	18.6	14.5	35.7	14.0
Total Optoelectronic	59.8	85.5	119.1	145.9	150.2	170.1	199.0	248.9	19.5	724.3	23.8
LED Lamps	16.6	24.0	25.9	24.7	24.9	24.4	27.0	31.5	4.7	86.9	22.5
LED Displays	23.1	32.9	43.7	51.9	52.9	55.5	63.7	75.9	15.0	216.2	23.3
Optical Couplers	5.2	7.5	11.0	17.4	20.0	22.1	27.3	35.5	29.5	105.8	24.4
Other Optoelectronics	14.9	21.1	38.5	51.9	52.4	68.2	81.1	106.0	30.8	315.4	24.4
Exchange Rate (Yen/US$)	248.0	235.0	235.0	235.0	235.0	235.0	235.0	235.0		235.0	

Source: DATAQUEST

TABLE 9

HISTORICAL WESTERN EUROPEAN SEMICONDUCTOR CONSUMPTION
(Millions of Dollars)
1974 through 1983

	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	CAG % (74-83)
Total Semiconductor	1,591	1,333	1,594	1,853	2,339	3,018	3,686	3,041	3,167	3,370	8.7
Total Integrated Circuit	618	561	676	904	1,238	1,747	2,333	1,892	1,988	2,323	15.8
Bipolar Digital (Technology)	229	189	186	228	291	390	510	454	434	483	8.6
TTL											
DTL											
ECL											
Other Bipolar Digital											
Bipolar Digital (Function)	229	189	186	228	291	390	510	454	434	483	8.6
Bipolar Digital Memory						85	116	103	100	107	
Bipolar Digital Logic						305	394	351	334	376	
MOS (Technology)	168	158	226	352	535	781	1,139	882	948	1,227	24.7
NMOS											
PMOS											
CMOS											
MOS (Function)	168	158	226	352	535	781	1,139	882	948	1,227	24.7
MOS Memory						367	543	426	469	581	
MOS Microprocessor						125	189	149	168	239	
MOS Logic						289	407	307	311	407	
Linear	221	214	264	324	412	576	684	556	606	613	12.0
Total Discrete	944	728	851	881	1,004	1,138	1,192	995	1,011	866	(1.0)
Transistor	463	351	400	424	463	511	511	463	468	405	(1.5)
Small Signal Transistor	289	243	248	244	265	286	275	251	247	209	(3.5)
Power Transistor	174	108	152	180	198	225	236	212	221	196	1.3
Diode	362	282	318	342	402	460	503	384	391	330	(1.0)
Small Signal Diode	112	72	117	139	182	228	225	157	154	124	1.1
Power Diode	194	173	163	170	184	194	231	192	202	178	(1.0)
Zener Diode	56	37	38	33	36	38	47	35	35	28	(7.4)
Thyristor	100	82	99	97	110	118	133	103	105	91	(1.0)
Other Discrete	19	13	34	18	29	49	45	45	47	40	8.6
Total Optoelectronic	29	44	67	68	97	133	161	154	168	181	22.6
LED Lamps	6	10	23	27	35	42	41	41	44	47	25.7
LED Displays	13	17	22	26	41	54	58	57	65	64	19.4
Optical Couplers	4	5	5	6	10	19	27	27	28	33	26.4
Other Optoelectronics	6	12	17	9	11	18	35	29	31	37	22.4

Source: DATAQUEST

TABLE 10

WESTERN EUROPEAN SEMICONDUCTOR CONSUMPTION FORECAST
(Millions of Dollars)
1982 through 1989, plus 1994

	1982	1983	1984	1985	1986	1987	1988	1989	CAG % (83-89)	1994	CAG % (89-94)
Total Semiconductor	3,167	3,370	4,212	5,305	6,154	6,523	7,828	9,860	19.6	24,510	20.0
Total Integrated Circuit	1,988	2,323	3,081	4,080	4,849	5,249	6,471	8,380	23.8	22,360	21.7
Bipolar Digital (Technology)	434	483	604	762	882	919	1,092	1,310	18.1	2,650	15.1
TTL											
DTL											
ECL											
Other Bipolar Digital											
Bipolar Digital (Function)	434	483	604	762	882	919	1,092	1,310	18.1	2,650	15.1
Bipolar Digital Memory	100	107	143	183	213	226	269	320	20.0	660	15.6
Bipolar Digital Logic	334	376	461	579	669	693	823	990	17.5	1,990	15.0
MOS (Technology)	948	1,227	1,772	2,499	3,047	3,392	4,314	5,840	29.7	17,820	25.0
NMOS											
PMOS											
CMOS											
MOS (Function)	948	1,227	1,772	2,499	3,047	3,392	4,314	5,840	29.7	17,820	25.0
MOS Memory	469	581	801	1,067	1,251	1,340	1,670	2,183	24.7	5,570	20.6
MOS Microprocessor	168	239	379	588	758	888	1,174	1,662	38.2	6,190	30.1
MOS Logic	311	407	592	844	1,038	1,164	1,470	1,995	30.3	6,060	24.9
Linear	606	613	705	819	920	938	1,065	1,230	12.3	1,890	9.0
Total Discrete	1,011	866	914	965	1,009	951	983	1,035	3.0	1,160	2.3
Transistor	468	405	422	445	465	437	451	474	2.7	530	2.3
Small Signal Transistor	247	209	215	215	218	200	200	204	(0.4)	185	(1.9)
Power Transistor	221	196	207	230	247	237	251	270	5.5	345	5.0
Diode	391	330	353	373	389	367	379	398	3.2	430	1.6
Small Signal Diode	154	124	130	133	135	124	124	126	0.3	107	(3.2)
Power Diode	202	178	192	207	220	211	222	238	5.0	292	4.2
Zener Diode	35	28	31	33	34	32	33	34	3.3	31	(1.8)
Thyristor	105	91	97	103	109	103	107	113	3.7	137	3.9
Other Discrete	47	40	42	44	46	44	46	50	3.8	63	4.7
Total Optoelectronic	168	181	217	260	296	323	374	445	16.2	990	17.3
LED Lamps	44	47	53	60	64	66	72	80	9.3	160	14.9
LED Displays	65	64	75	87	95	98	106	113	9.9	130	2.8
Optical Couplers	28	33	43	56	69	81	101	132	26.0	380	23.5
Other Optoelectronics	31	37	46	57	68	78	95	120	21.7	320	21.7

Source: DATAQUEST

TABLE 11

HISTORICAL REST OF WORLD SEMICONDUCTOR CONSUMPTION
(Millions of Dollars)
1974 through 1983

	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	CAG % (74-83)
Total Semiconductor	236	225	333	471	600	790	996	963	1,042	1,461	22.5
Total Integrated Circuit	82	90	134	184	258	364	450	494	585	929	31.0
Bipolar Digital (Technology)	42	30	35	39	45	79	108	106	113	162	16.2
TTL											
DTL											
ECL											
Other Bipolar Digital											
Bipolar Digital (Function)	42	30	35	39	45	79	108	106	113	162	16.2
Bipolar Digital Memory						2	3	3	4	4	
Bipolar Digital Logic						77	105	103	109	158	
MOS (Technology)	22	44	67	88	110	100	143	171	248	450	39.8
NMOS											
PMOS											
CMOS											
MOS (Function)	22	44	67	88	110	100	143	171	248	450	39.8
MOS Memory						25	34	51	106	194	
MOS Microprocessor						17	27	43	63	112	
MOS Logic						58	82	77	79	144	
Linear	18	16	32	57	103	185	199	217	224	317	37.5
Total Discrete	141	117	171	245	286	334	416	355	345	402	12.3
Transistor	82	62	92	117	123	200	270	210	209	243	12.8
Small Signal Transistor	43	27	44	53	52	83	109	113	150	174	16.8
Power Transistor	39	35	48	64	71	117	161	97	59	69	6.5
Diode	37	36	62	85	115	78	88	94	63	72	7.7
Small Signal Diode	20	16	18	27	28	47	51	28	12	9	(8.5)
Power Diode	14	18	32	44	66	26	32	57	38	47	14.4
Zener Diode	3	2	12	14	21	5	5	9	13	16	20.4
Thyristor	12	9	8	23	26	36	35	37	33	38	13.7
Other Discrete	10	10	9	20	22	20	23	14	40	49	19.3
Total Optoelectronic	13	18	28	42	56	92	130	114	112	130	29.2
LED Lamps	1	4	7	15	18	28	43	39	33	36	48.9
LED Displays	8	9	12	15	18	42	58	46	48	55	23.9
Optical Couplers	1	1	3	3	8	6	8	6	8	10	29.2
Other Optoelectronics	3	4	6	9	12	16	21	23	23	29	28.7

Source: DATAQUEST

TABLE 12

REST OF WORLD SEMICONDUCTOR CONSUMPTION FORECAST
(Millions of Dollars)
1982 through 1989, plus 1994

	1982	1983	1984	1985	1986	1987	1988	1989	CAG % (83-89)	1994	CAG % (89-94)
Total Semiconductor	1,042	1,461	2,030	2,563	2,967	3,108	3,849	5,018	22.8	13,639	22.1
Total Integrated Circuit	585	929	1,363	1,824	2,191	2,248	2,797	3,784	26.4	11,367	24.6
Bipolar Digital (Technology)	113	162	239	332	398	397	476	618	25.0	1,339	16.7
TTL											
DTL											
ECL											
Other Bipolar Digital											
Bipolar Digital (Function)	113	162	239	332	398	397	476	618	25.0	1,339	16.7
Bipolar Digital Memory	4	4	6	8	9	10	14	19	29.7	45	18.8
Bipolar Digital Logic	109	158	233	324	389	387	462	599	24.9	1,294	16.7
MOS (Technology)	248	450	721	1,025	1,276	1,330	1,681	2,301	31.3	7,964	28.2
NMOS											
PMOS											
CMOS											
MOS (Function)	248	450	721	1,025	1,276	1,330	1,681	2,301	31.3	7,964	28.2
MOS Memory	106	194	328	469	586	600	780	1,092	33.4	4,055	30.0
MOS Microprocessor	63	112	166	227	279	300	385	539	29.9	1,781	27.0
MOS Logic	79	144	227	329	411	430	516	670	29.2	2,128	26.0
Linear	224	317	403	467	517	521	640	865	18.2	2,064	19.0
Total Discrete	345	402	511	561	589	626	748	854	13.4	1,272	8.3
Transistor	209	243	312	345	362	382	465	534	14.0	801	8.4
Small Signal Transistor	150	174	220	245	255	268	320	360	12.9	493	6.5
Power Transistor	59	69	92	100	107	114	145	174	16.7	308	12.1
Diode	63	72	94	102	108	118	140	160	14.2	238	8.3
Small Signal Diode	12	9	12	13	14	15	18	21	15.2	32	8.8
Power Diode	38	47	59	64	67	74	90	103	14.0	156	8.7
Zener Diode	13	16	23	25	27	29	32	36	14.5	50	6.8
Thyristor	33	38	45	49	51	52	63	70	10.7	102	7.8
Other Discrete	40	49	60	65	68	74	80	90	10.7	131	7.8
Total Optoelectronic	112	130	156	178	187	234	304	380	19.6	1,000	21.4
LED Lamps	33	36	38	41	43	48	59	83	14.9	191	18.1
LED Displays	48	55	67	79	82	93	119	137	16.4	350	20.6
Optical Couplers	8	10	14	19	21	29	37	50	30.8	160	26.2
Other Optoelectronics	23	29	37	39	41	64	89	110	24.9	299	22.1

Source: DATAQUEST

TABLE 14

WORLDWIDE AVERAGE SELLING PRICES FORECAST
(Dollars)
1982 through 1989, plus 1994

	1982	1983	1984	1985	1986	1987	1988	1989	CAG % (83-89)	1994	CAG % (89-94)
Total Semiconductor	0.34	0.34	0.38	0.37	0.40	0.42	0.44	0.51	6.8	0.80	9.5
Total Integrated Circuit	1.01	1.05	1.17	1.25	1.29	1.32	1.42	1.55	6.8	2.01	5.3
Bipolar Digital (Technology)	0.62	0.65	0.70	0.75	0.80	0.90	0.95	1.00	7.4	1.15	2.8
TTL											
DTL											
ECL											
Other Bipolar Digital											
Bipolar Digital (Function)	0.62	0.65	0.70	0.75	0.80	0.90	0.95	1.00	7.4	1.15	2.8
Bipolar Digital Memory											
Bipolar Digital Logic											
MOS (Technology)	1.71	1.76	2.05	2.16	2.16	2.04	2.13	2.35	4.9	2.79	3.5
NMOS	2.91	3.15	3.15	3.16	3.16	3.17	3.17	3.18	0.2	3.24	0.4
PMOS	1.70	1.75	1.75	1.75	1.75	1.76	1.76	1.76	0.1	1.78	0.2
CMOS	0.77	0.81	1.04	1.25	1.45	1.54	1.74	2.01	16.4	2.70	6.1
MOS (Function)	1.71	1.76	2.05	2.16	2.16	2.04	2.13	2.35	4.9	2.79	3.5
MOS Memory	3.09	3.25	3.79	3.80	3.43	2.89	2.86	3.10	(0.8)	3.50	2.5
MOS Microprocessor	3.34	3.36	3.53	3.51	3.40	3.25	3.37	3.30	(0.3)	3.65	2.0
MOS Logic	0.80	0.79	0.85	0.92	0.99	1.05	1.14	1.29	8.5	1.47	2.6
Linear	0.79	0.76	0.75	0.73	0.72	0.72	0.74	0.75	(0.2)	0.81	1.6
Total Discrete	0.11	0.09	0.09	0.07	0.07	0.07	0.07	0.07	(4.7)	0.07	(1.1)
Transistor	0.14	0.12	0.11	0.09	0.10	0.10	0.08	0.08	(6.3)	0.07	(2.6)
Small Signal Transistor	0.08	0.07	0.06	0.05	0.05	0.05	0.04	0.04	(8.9)	0.03	(5.6)
Power Transistor	0.54	0.49	0.47	0.45	0.45	0.44	0.42	0.42	(2.5)	0.39	(1.5)
Diode	0.07	0.06	0.06	0.04	0.04	0.04	0.04	0.04	(4.3)	0.04	(0.3)
Small Signal Diode	0.04	0.03	0.03	0.02	0.02	0.02	0.02	0.02	(6.5)	0.02	0.0
Power Diode	0.09	0.09	0.09	0.08	0.08	0.07	0.07	0.07	(4.1)	0.06	(3.0)
Zener Diode	0.13	0.12	0.12	0.11	0.11	0.10	0.10	0.10	(3.0)	0.11	1.9
Thyristor	0.95	0.92	0.90	0.89	0.89	0.89	0.88	0.87	(0.9)	0.85	(0.5)
Other Discrete	0.23	0.23	0.23	0.22	0.22	0.21	0.21	0.20	(2.3)	0.18	(2.1)
Total Optoelectronic	0.37	0.36	0.36	0.38	0.36	0.38	0.36	0.36	0.1	0.35	(0.8)
LED Lamps	0.12	0.12	0.11	0.11	0.10	0.10	0.09	0.09	(4.7)	0.08	(2.3)
LED Displays	1.30	1.37	1.35	1.34	1.30	1.30	1.29	1.29	(1.0)	1.25	(0.6)
Optical Couplers	0.70	0.66	0.65	0.64	0.62	0.62	0.61	0.61	(1.3)	0.59	(0.7)
Other Optoelectronics	1.11	1.07	1.06	1.05	1.03	1.03	1.02	1.00	(1.1)	0.98	(0.4)

Source: DATAQUEST

TABLE 16

WORLDWIDE SEMICONDUCTOR CONSUMPTION FORECAST
(Millions of Units)
1982 through 1989, plus 1994

	1982	1983	1984	1985	1986	1987	1988	1989	CAG % (83-89)	1994	CAG % (89-94)
Total Semiconductor	43,951	54,533	67,633	89,745	93,317	98,205	113,449	126,000	15.0	219,522	11.7
Total Integrated Circuit	10,625	13,516	17,335	21,352	23,897	25,995	29,959	35,731	17.6	79,658	17.4
Bipolar Digital (Technology)	3,911	4,682	5,924	6,759	6,956	6,180	6,857	7,808	8.9	12,510	9.9
TTL											
DTL											
ECL											
Other Bipolar Digital											
Bipolar Digital (Function)	3,911	4,682	5,924	6,759	6,956	6,180	6,857	7,808	8.9	12,510	9.9
Bipolar Digital Memory											
Bipolar Digital Logic											
MOS (Technology)	3,245	4,366	5,860	7,633	9,042	11,045	13,536	16,686	25.0	46,375	22.7
NMOS	1,337	1,705	2,739	3,602	3,733	3,377	3,735	4,873	19.1	7,236	8.2
PMOS	194	184	171	157	146	122	88	85	(12.0)	81	(0.9)
CMOS	1,714	2,476	2,949	3,874	5,163	7,545	9,713	11,728	29.6	39,057	27.2
MOS (Function)	3,245	4,366	5,860	7,633	9,042	11,045	13,536	16,686	25.0	46,375	22.7
MOS Memory	866	1,129	1,640	2,246	2,873	3,610	4,549	5,769	31.2	17,290	24.5
MOS Microprocessor	381	571	814	1,156	1,494	1,942	2,526	3,599	35.9	11,880	27.0
MOS Logic	1,999	2,666	3,406	4,232	4,675	5,492	6,461	7,318	18.3	17,205	18.6
Linear	3,468	4,468	5,551	6,960	7,899	8,771	9,566	11,237	16.6	20,774	13.1
Total Discrete	31,147	38,243	46,824	64,483	64,821	67,376	77,321	82,747	13.7	119,179	7.6
Transistor	12,285	15,186	20,343	26,207	25,998	27,156	36,183	39,321	17.2	63,177	9.9
Small Signal Transistor	10,813	13,400	18,000	23,340	23,000	24,020	32,500	35,100	17.4	56,033	9.8
Power Transistor	1,472	1,786	2,343	2,867	2,998	3,136	3,683	4,221	15.4	7,144	11.1
Diode	17,782	21,925	25,078	36,628	37,088	38,377	39,137	41,107	11.0	52,079	4.8
Small Signal Diode	9,575	12,900	14,400	23,100	23,050	22,500	22,500	23,500	10.5	26,200	2.2
Power Diode	6,922	7,667	9,044	11,538	11,938	13,557	14,157	14,957	11.8	22,833	8.8
Zener Diode	1,285	1,358	1,633	1,991	2,100	2,320	2,480	2,650	11.8	3,045	2.8
Thyristor	324	341	403	444	454	452	482	518	7.2	679	5.5
Other Discrete	757	791	1,000	1,205	1,282	1,390	1,519	1,800	14.7	3,244	12.5
Total Optoelectronic	2,179	2,774	3,475	3,910	4,599	4,834	6,168	7,602	18.3	20,685	22.2
LED Lamps	1,600	2,050	2,527	2,718	3,250	3,240	4,200	5,111	16.4	13,738	21.9
LED Displays	227	261	327	386	423	442	522	597	14.8	1,417	18.9
Optical Couplers	176	233	292	392	468	563	723	923	25.8	2,690	23.9
Other Optoelectronics	177	230	328	413	458	588	724	971	27.1	2,841	23.9

Source: DATAQUEST

TABLE 17

HISTORICAL WORLDWIDE SEMICONDUCTOR FACTORY SHIPMENTS
(Millions of Dollars)
1974 through 1983

	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	CAG % (74-83)
Total Semiconductor	5,405	4,373	5,827	6,916	8,868	11,088	14,056	14,334	14,832	18,685	14.8
Total Integrated Circuit	2,510	2,120	2,941	3,770	5,268	7,077	9,659	9,788	10,711	14,133	21.2
Bipolar Digital (Technology)	979	682	865	1,060	1,320	1,690	2,409	2,362	2,425	3,043	13.4
TTL	719	499	682	852	1,046	1,375	2,076	2,004	2,058	2,623	15.5
DTL	105	81	71	61	56	52	45	43	40	40	(10.2)
ECL	73	55	76	100	140	170	189	220	235	290	16.6
Other Bipolar Digital	82	47	36	47	78	93	99	95	92	90	1.0
Bipolar Digital (Function)	979	682	865	1,060	1,320	1,690	2,409	2,362	2,425	3,043	13.4
Bipolar Digital Memory						326	556	553	508	601	
Bipolar Digital Logic						1,364	1,853	1,809	1,917	2,442	
MOS (Technology)	880	837	1,239	1,613	2,398	3,460	4,890	4,749	5,546	7,694	27.2
NMOS	72	133	377	716	1,477	2,364	3,469	3,188	3,891	5,372	61.5
PMOS	697	609	658	613	574	557	473	387	330	322	(8.2)
CMOS	111	95	204	284	347	539	948	1,174	1,325	2,000	37.9
MOS (Function)	880	837	1,239	1,613	2,398	3,460	4,890	4,749	5,546	7,694	27.2
MOS Memory						1,672	2,263	2,041	2,675	3,669	
MOS Microprocessor						570	892	1,070	1,272	1,919	
MOS Logic						1,218	1,735	1,638	1,599	2,106	
Linear	651	601	837	1,097	1,550	1,927	2,360	2,677	2,740	3,396	20.1
Total Discrete	2,700	2,028	2,598	2,840	3,184	3,407	3,673	3,763	3,315	3,549	3.1
Transistor	1,400	1,063	1,333	1,429	1,535	1,658	1,766	1,905	1,660	1,813	2.9
Small Signal Transistor	874	638	793	799	844	870	897	1,025	865	938	0.8
Power Transistor	526	425	540	630	691	788	869	880	795	875	5.8
Diode	944	709	911	997	1,184	1,219	1,346	1,324	1,173	1,240	3.1
Small Signal Diode	323	211	286	309	362	420	450	432	383	387	2.0
Power Diode	482	398	504	559	657	653	728	723	623	690	4.1
Zener Diode	139	100	121	129	165	146	168	169	167	163	1.8
Thyristor	232	180	241	293	317	360	392	352	308	314	3.4
Other Discrete	124	76	113	121	148	170	169	182	174	182	4.4
Total Optoelectronic	195	225	288	306	416	604	724	783	806	1,003	20.0
LED Lamps	23	32	54	65	89	124	148	178	192	246	30.1
LED Displays	120	128	151	144	193	255	291	292	295	357	12.9
Optical Couplers	21	22	29	33	50	86	104	114	123	154	24.8
Other Optoelectronics	31	43	54	64	84	139	181	199	196	246	25.9

Source: DATAQUEST

TABLE 18

HISTORICAL NORTH AMERICAN SEMICONDUCTOR FACTORY SHIPMENTS
(Millions of Dollars)
1974 through 1983

	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	CAG % (74-83)
Total Semiconductor	2,626	2,119	2,665	3,152	3,857	5,079	6,447	6,287	6,822	8,499	13.9
Total Integrated Circuit	1,499	1,216	1,612	2,110	2,721	3,717	4,999	4,820	5,473	7,650	18.8
Bipolar Digital (Technology)	595	395	505	655	797	976	1,468	1,393	1,381	1,757	12.8
TTL	470	303	410	571	686	853	1,307	1,248	1,239	1,593	14.5
DTL	49	43	41	34	33	27	21	15	13	15	(12.3)
ECL	45	33	39	40	57	69	96	90	89	99	9.2
Other Bipolar Digital	31	16	15	10	21	27	44	40	40	50	5.5
Bipolar Digital (Function)	595	395	505	655	797	976	1,468	1,393	1,381	1,757	12.8
Bipolar Digital Memory											
Bipolar Digital Logic											
MOS (Technology)	595	538	791	1,034	1,382	2,043	2,660	2,482	3,046	3,945	23.4
NMOS	66	108	301	545	924	1,466	1,919	1,679	2,166	2,840	51.9
PMOS	435	353	327	261	200	186	198	162	166	158	(10.6)
CMOS	94	77	163	228	258	391	543	641	714	947	29.3
MOS (Function)	595	538	791	1,034	1,382	2,043	2,660	2,482	3,046	3,945	23.4
MOS Memory											
MOS Microprocessor											
MOS Logic											
Linear	309	283	316	421	542	698	871	945	1,046	1,348	17.8
Total Discrete	983	751	889	914	975	1,105	1,169	1,191	1,062	1,107	1.3
Transistor	468	368	418	429	495	579	592	608	561	571	2.2
Small Signal Transistor	254	189	225	215	252	292	284	289	272	281	1.1
Power Transistor	214	179	193	214	243	287	308	319	289	290	3.4
Diode	327	256	300	322	331	359	397	411	385	406	2.4
Small Signal Diode	95	62	73	72	47	60	59	59	69	57	(5.5)
Power Diode	169	142	164	187	193	215	244	258	201	259	4.9
Zener Diode	63	52	63	63	91	84	94	94	115	90	4.0
Thyristor	102	75	104	111	110	130	142	141	97	107	0.5
Other Discrete	86	52	67	52	39	37	38	31	19	23	(13.6)
Total Optoelectronic	144	152	164	128	161	257	279	276	287	342	10.1
LED Lamps	13	15	19	21	25	30	35	40	49	63	19.2
LED Displays	98	98	99	69	80	117	110	108	89	100	0.2
Optical Couplers	15	14	20	19	28	49	60	56	68	81	20.6
Other Optoelectronics	18	25	26	19	28	61	74	72	81	98	20.7

Source: DATAQUEST

TABLE 19

HISTORICAL JAPANESE SEMICONDUCTOR FACTORY SHIPMENTS
(Millions of Dollars)
1974 through 1983

	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	CAG % (74-83)
Total Semiconductor	1,199	925	1,521	1,826	2,555	2,869	3,861	4,814	4,748	6,380	20.4
Total Integrated Circuit	429	396	665	804	1,350	1,730	2,539	3,143	3,309	4,595	30.1
Bipolar Digital (Technology)	108	76	106	140	196	231	323	428	517	614	21.3
TTL											
DTL											
ECL											
Other Bipolar Digital											
Bipolar Digital (Function)	108	76	106	140	196	231	323	428	517	614	21.3
Bipolar Digital Memory											
Bipolar Digital Logic											
MOS (Technology)	160	186	290	332	630	887	1,379	1,560	1,730	2,652	36.6
NMOS	4	19	60	118	392	604	979	1,069	1,242	1,826	97.5
PMOS	146	154	200	180	184	195	120	102	81	80	(6.5)
CMOS	10	13	30	34	54	88	280	389	407	746	61.5
MOS (Function)	160	186	290	332	630	887	1,379	1,560	1,730	2,652	36.6
MOS Memory											
MOS Microprocessor											
MOS Logic											
Linear	161	134	269	332	524	612	837	1,155	1,062	1,329	26.4
Total Discrete	754	507	818	953	1,101	981	1,103	1,388	1,158	1,386	7.0
Transistor	439	305	474	526	555	472	511	709	527	678	4.9
Small Signal Transistor	310	189	302	309	338	254	268	392	263	332	0.8
Power Transistor	129	116	172	217	217	218	243	317	264	346	11.6
Diode	248	164	277	313	395	359	426	492	449	507	8.3
Small Signal Diode	88	58	88	96	119	125	152	198	192	208	10.0
Power Diode	134	88	162	187	233	202	238	254	221	256	7.5
Zener Diode	26	18	27	30	43	32	36	40	36	43	5.7
Thyristor	46	27	46	70	86	83	93	94	78	90	7.7
Other Discrete	21	11	21	44	65	67	73	93	104	111	20.3
Total Optoelectronic	16	22	38	69	104	158	219	283	261	399	43.0
LED Lamps	2	3	6	6	13	43	71	87	86	119	57.5
LED Displays	8	10	21	33	53	59	81	100	104	149	38.4
Optical Couplers	2	3	3	3	8	11	14	23	24	35	37.4
Other Optoelectronics	4	6	8	27	30	45	53	73	67	96	42.3

Source: DATAQUEST

TABLE 20

HISTORICAL JAPANESE SEMICONDUCTOR FACTORY SHIPMENTS
(Billions of Yen)
1974 through 1983

	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	CAG % (74-83)
Total Semiconductor	350.1	274.7	450.2	491.2	536.5	628.3	876.4	1,063.9	1,177.5	1,499.3	17.5
Total Integrated Circuit	125.3	117.6	196.8	216.3	283.5	378.9	576.4	694.6	820.6	1,079.8	27.0
Bipolar Digital (Technology)	31.5	22.6	31.4	37.7	41.2	50.6	73.3	94.6	128.2	144.3	18.4
TTL											
DTL											
ECL											
Other Bipolar Digital											
Bipolar Digital (Function)	31.5	22.6	31.4	37.7	41.2	50.6	73.3	94.6	128.2	144.3	18.4
Bipolar Digital Memory											
Bipolar Digital Logic											
MOS (Technology)	46.7	55.2	85.8	89.3	132.3	194.3	313.0	344.8	429.0	623.2	33.4
NMOS	1.2	5.6	17.8	31.7	82.3	132.3	222.2	236.2	308.0	429.1	82.8
PMOS	42.6	45.7	59.2	48.4	38.6	42.7	27.2	22.5	20.1	18.8	(8.7)
CMOS	2.9	3.9	8.9	9.1	11.3	19.3	63.6	86.0	100.9	175.3	57.6
MOS (Function)	46.7	55.2	85.8	89.3	132.3	194.3	313.0	344.8	429.0	623.2	33.4
MOS Memory											
MOS Microprocessor											
MOS Logic											
Linear	47.0	39.8	79.6	89.3	110.0	134.0	190.0	255.3	263.4	312.3	23.4
Total Discrete	220.2	150.6	242.1	256.4	231.2	214.8	250.4	306.7	287.2	325.7	4.4
Transistor	128.2	90.6	140.3	141.5	116.6	103.4	116.0	156.7	130.7	159.3	2.4
Small Signal Transistor	90.5	56.1	89.4	83.1	71.0	55.6	60.8	86.6	65.2	78.0	(1.6)
Power Transistor	37.7	34.5	50.9	58.4	45.6	47.7	55.2	70.1	65.5	81.3	8.9
Diode	72.4	48.7	82.0	84.2	82.9	78.6	96.7	108.7	111.4	119.1	5.7
Small Signal Diode	25.7	17.2	26.0	25.8	25.0	27.4	34.5	43.8	47.6	48.9	7.4
Power Diode	39.1	26.1	48.0	50.3	48.9	44.2	54.0	56.1	54.8	60.2	4.9
Zener Diode	7.6	5.3	8.0	8.1	9.0	7.0	8.2	8.8	8.9	10.1	3.2
Thyristor	13.4	8.0	13.6	18.8	18.1	18.2	21.1	20.8	19.3	21.1	5.2
Other Discrete	6.1	3.3	6.2	11.8	13.6	14.7	16.6	20.6	25.8	26.1	17.5
Total Optoelectronic	4.7	6.5	11.2	18.6	21.8	34.6	49.7	62.5	69.7	93.8	39.5
LED Lamps	0.6	0.9	1.8	1.6	2.7	9.4	16.1	19.2	21.3	28.0	53.7
LED Displays	2.3	3.0	6.2	8.9	11.1	12.9	18.4	22.1	25.8	35.0	35.1
Optical Couplers	0.6	0.9	0.9	0.8	1.7	2.4	3.2	5.1	6.0	8.2	34.2
Other Optoelectronics	1.2	1.8	2.4	7.3	6.3	9.9	12.0	16.1	16.6	22.6	39.0
Exchange Rate (Yen/US$)	292.0	297.0	296.0	269.0	210.0	219.0	227.0	221.0	248.0	235.0	

Source: DATAQUEST

TABLE 21

HISTORICAL WESTERN EUROPEAN SEMICONDUCTOR FACTORY SHIPMENTS
(Millions of Dollars)
1974 through 1983

	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	CAG % (74-83)
Total Semiconductor	1,448	1,209	1,443	1,737	2,204	2,706	3,181	2,722	2,726	3,043	8.6
Total Integrated Circuit	531	457	559	750	1,064	1,431	1,867	1,566	1,608	2,012	16.0
Bipolar Digital (Technology)	246	181	187	206	259	386	500	435	404	460	7.2
TTL											
OTL											
ECL											
Other Bipolar Digital											
Bipolar Digital (Function)	246	181	187	206	259	386	500	435	404	460	7.2
Bipolar Digital Memory											
Bipolar Digital Logic											
MOS (Technology)	122	108	152	238	364	481	780	629	660	964	25.8
NMOS	2	6	16	53	153	279	550	418	460	665	90.6
PMOS	113	97	125	163	179	157	140	114	78	82	(3.5)
CMOS	7	5	11	22	32	45	90	97	122	217	46.5
MOS (Function)	122	108	152	238	364	481	780	629	660	964	25.8
MOS Memory											
MOS Microprocessor											
MOS Logic											
Linear	163	168	220	306	441	564	587	502	544	588	15.3
Total Discrete	893	717	823	898	1,012	1,137	1,157	1,000	943	845	(0.6)
Transistor	443	350	385	415	421	463	472	448	455	385	(1.5)
Small Signal Transistor	260	220	215	222	197	208	208	237	233	195	(3.1)
Power Transistor	183	130	170	193	224	255	264	211	222	190	0.4
Diode	349	276	322	348	433	471	481	387	312	300	(1.7)
Small Signal Diode	120	78	113	127	176	215	213	155	107	105	(1.5)
Power Diode	179	168	178	185	229	230	236	202	194	171	(0.5)
Zener Diode	50	30	31	36	28	26	32	30	11	24	(7.8)
Thyristor	84	78	91	111	118	142	151	111	128	114	3.5
Other Discrete	17	13	25	24	40	61	53	54	48	46	11.7
Total Optoelectronic	24	35	61	89	128	138	157	156	175	186	25.5
LED Lamps	6	10	23	35	47	41	32	39	43	49	26.3
LED Displays	9	13	20	31	44	53	54	46	66	66	24.8
Optical Couplers	3	3	4	9	13	17	25	27	28	34	31.0
Other Optoelectronics	6	9	14	14	24	27	46	44	38	37	22.4

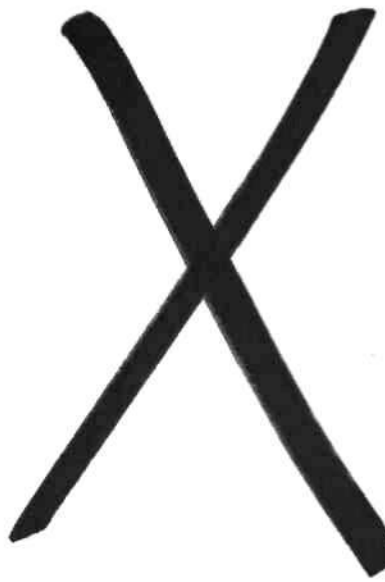
Source: DATAQUEST

TABLE 22

HISTORICAL REST OF WORLD SEMICONDUCTOR FACTORY SHIPMENTS
(Millions of Dollars)
1974 through 1983

	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	CAG % (74-83)
Total Semiconductor	132	120	198	201	252	434	567	511	536	763	21.5
Total Integrated Circuit	51	51	105	106	133	199	254	259	321	476	28.2
Bipolar Digital (Technology)	30	30	67	59	68	97	118	106	123	212	24.3
TTL											
DTL											
ECL											
Other Bipolar Digital											
Bipolar Digital (Function)	30	30	67	59	68	97	118	106	123	212	24.3
Bipolar Digital Memory											
Bipolar Digital Logic											
MOS (Technology)	3	5	6	9	22	49	71	78	110	133	52.4
NMOS					8	15	21	22	23	41	
PMOS	3	5	6	9	11	19	15	9	5	2	(4.4)
CMOS					3	15	35	47	82	90	
MOS (Function)	3	5	6	9	22	49	71	78	110	133	52.4
MOS Memory											
MOS Microprocessor											
MOS Logic											
Linear	18	16	32	38	43	53	65	75	88	131	24.7
Total Discrete	70	53	68	75	96	184	244	184	152	211	13.0
Transistor	50	40	56	59	64	144	191	140	117	179	15.2
Small Signal Transistor	50	40	51	53	57	116	137	107	97	130	11.2
Power Transistor			5	6	7	28	54	33	20	49	
Diode	20	13	12	14	25	30	42	34	27	27	3.4
Small Signal Diode	20	13	12	14	20	20	26	20	15	17	(1.8)
Power Diode					2	6	10	9	7	4	
Zener Diode					3	4	6	5	5	6	
Thyristor				1	3	5	6	6	5	3	
Other Discrete				1	4	5	5	4	3	2	
Total Optoelectronic	11	16	25	20	23	51	69	68	63	76	24.0
LED Lamps	2	4	6	3	4	10	10	12	14	15	25.1
LED Displays	5	7	11	11	16	26	46	38	36	42	26.7
Optical Couplers	1	2	2	2	1	9	5	8	3	4	16.7
Other Optoelectronics	3	3	6	4	2	6	8	10	10	15	19.6

Source: DATAQUEST



Consumption and Shipment Data

The following is a list of the material in this section:

Consumption and Factory Shipments

INTRODUCTION

Consumption/factory shipments data comprise a set of detailed tables that estimate semiconductor consumption and semiconductor factory shipments both worldwide and for four major geographical regions for the years 1975 through 1990 and 1995. Semiconductor consumption tables are divided into historical data tables and forecast tables. Semiconductor factory shipments tables are historical data tables only. All historical tables begin with 1975 and end with 1984, while all forecast tables provide annual market size estimates for 1983 through 1990, with additional estimates for 1995. Please refer to the "Forecast" section for a discussion of the differences between historical and future dollar values. A list of tables detailing the type of data, region, years and units, is as follows:

LIST OF TABLES--CONSUMPTION/FACTORY SHIPMENTS

Table	Region Covered	Years	Units
0	Japan, Western Europe Exchange Rates	1970-1984	Various
1	Worldwide Consumption	1975-1984	Dollars
2	Worldwide Consumption	1983-1990; 1995	Dollars
3	North America Consumption	1975-1984	Dollars
4	North America Consumption	1983-1990; 1995	Dollars
5	Japan Consumption	1975-1984	Dollars
6	Japan Consumption	1983-1990; 1995	Dollars
7	Japan Consumption	1975-1984	Yen
8	Japan Consumption	1983-1990; 1995	Yen
9	Western Europe Consumption	1975-1984	Dollars
10	Western Europe Consumption	1983-1990; 1995	Dollars
11	Rest of World Consumption	1975-1984	Dollars
12	Rest of World Consumption	1983-1990; 1995	Dollars
13	Worldwide Average Selling Price	1975-1984	Dollars
14	Worldwide Average Selling Price	1983-1990; 1995	Dollars
15	Worldwide Consumption	1975-1984	Units
16	Worldwide Consumption	1983-1990; 1995	Units
17	Worldwide Factory Shipments	1975-1984	Dollars
18	North America Factory Shipments	1975-1984	Dollars
19	Japan Factory Shipments	1975-1984	Dollars
20	Japan Factory Shipments	1975-1984	Yen
21	Western Europe Factory Shipments	1975-1984	Dollars
22	Rest of World Factory Shipments	1975-1984	Dollars

Consumption and Factory Shipments

Each table gives estimates of semiconductor consumption or factory shipments listed by the major semiconductor device product categories. In these tables, semiconductor components are divided into three major product groups: integrated circuits, discrete devices, and optoelectronic devices. These groups are divided into a number of subgroups, some of which are segmented further.

DEFINITIONS AND CONVENTIONS

DATAQUEST uses a common manufacturer base for all data tables. This base includes all suppliers to the merchant semiconductor market. It excludes captive suppliers that manufacture devices solely for the benefit of the parent company, such as ATT Technologies (formerly Western Electric), Burroughs, and IBM. Included, however, are companies that actively market semiconductor devices to the merchant market as well as to other divisions of their own companies. A recent case in point is NCR, previously a captive supplier, which in 1982 offered products on the merchant market for the first time. For such companies, both external shipments and internal consumption are included. Devices that are used internally are valued at current market prices.

Consumption--DATAQUEST defines consumption as the purchase of a semiconductor device or devices. This definition must be differentiated from actual use of the device in a final product. Devices that are inventoried at the user level are considered consumption according to our definition.

Factory Shipments Location--The fabrication and assembly of a semiconductor device may be performed in several different locations. Factory shipment is defined as occurring from that point where the device was tested and marked, irrespective of where the device was assembled or where the initial wafer fabrication was performed.

Hybrids--In earlier consumption/factory shipment data, hybrid devices were included as a separate segment of integrated circuits. However, since hybrid devices are primarily a special packaging arrangement, this segment has been omitted. Hybrid devices manufactured by semiconductor companies are now included in the most appropriate product segment, usually the linear segment.

Consumption and Factory Shipments

Power Devices--The difference between low-power and high-power transistors is set at the 1-watt power-handling capability. Power diodes are rated at 1 amp or higher; small-signal diodes are rated at less than 1 amp. Special discrete devices that are neither transistors, diodes, nor thyristors are categorized as "other discretes."

The manufacturer base product group definitions and guidelines for including value of output that we have used in our tables may differ from those used in other studies of this type. Our base is nearly the same as that used by the Semiconductor Industry Association (SIA).

Regions--North America is defined as including both the United States and Canada. Latin America, including Mexico, is considered part of the Rest of World (ROW) category. Western Europe includes Austria, Belgium, the Federal Republic of Germany, France, Greece, Italy, Luxembourg, the Scandinavian countries (Denmark, Finland, Norway, Sweden), Spain, and the United Kingdom.

DATA SOURCES

The information presented in the consumption/factory shipment data is a consolidation from a variety of sources, each of which focuses on a specific part of the market. These sources include the following:

- U.S. Commerce Department trade statistics and Semiconductor Trade Statistics Program (STSP) marketing data are used in determining North American consumption and factory shipments.
- Japanese trade statistics, compiled and published by the Ministry of Finance (MOF) and the Ministry of International Trade and Industry (MITI), are used to determine Japanese factory shipments and consumption in yen. The STSP also details semiconductor sales of U.S. and Western European manufacturers to Japan.
- For West European markets, U.S. Department of Commerce trade statistics, marketing statistics from the Semiconductor Industry Association (SIA), and shipment estimates for each company are the primary data sources used.
- U.S. Commerce Department trade statistics, STSP data, and MITI trade statistics constitute the major published sources used to estimate ROW consumption and factory shipments.

Consumption and Factory Shipments

DATAQUEST believes that the estimates presented here are the most accurate and meaningful generally available today. The sources of the data and the guidelines for the forecasts presented in the tables are:

- Unit sales or revenues (or both) published by major industry participants, both in the United States and abroad
- Estimates presented by knowledgeable and reliable industry spokesmen
- Government data or trade association data such as those from the Electronics Industry Association (EIA), MITI, SIA, and the U.S. Department of Commerce
- Published product literature and price lists
- Interviews with knowledgeable manufacturers, distributors, and users
- Relevant projected world economic data

CONSISTENCY

One of the key objectives in preparing these estimates is to achieve consistency among the various data elements that constitute the forecast and the historical data base. To ensure the accuracy and consistency of the estimates, we have compared the value of directly obtained data elements with values obtained by indirect means, wherever possible. Thus, the worldwide totals in the consumption/factory shipment analysis are consistent with the worldwide totals of the market share analysis. However, the regional factory shipments totals of the market share data do not and should not equal the regional factory shipments totals of the consumption/factory shipment tables because this analysis includes factories of all national origins producing in Japan. This would include companies like Texas Instruments Japan.

ACCURACY

The tables presented here represent DATAQUEST estimates that we believe are reasonably accurate. Where we have no reasonable estimate, none is given. A blank space in a table indicates that a reasonably accurate estimate is unavailable, and a zero in a table represents an estimate.

Consumption and Factory Shipments

VALUATION OF CONSUMPTION AND FACTORY SHIPMENTS

Regional consumption and factory shipments are all expressed in U.S. dollars (Japanese consumption and shipments are, however, also expressed in yen). To make the tables in this study useful in comparing different regions, it is necessary to express all values in a common currency and, because of the U.S. producers' large presence in international markets, the dollar is the preferred choice.

However, the choice of the U.S. dollar (or any single currency, for that matter) as the currency basis for the tables, brings with it some problems that require the readers' careful consideration in interpreting the data.

Inflation

All countries that participate significantly in international semiconductor markets suffered from an overall price inflation in the 1970s, continuing into the 1980s.

As a consequence, the dollar in a given year is not truly comparable with the dollar in any preceding year. Consumer and wholesale price indices and GNP deflators all measure price changes in various composite "market baskets" of goods. However, there is no price index that measures price changes of material, equipment, and labor inputs to the semiconductor industry. Indeed, the "mix" is changing so rapidly that what is used this year was sometimes unavailable last year, at any price. Nor is there a composite price index that measures price changes in aggregate semiconductor product. In an industry noted for its deflationary trends, this latter effect would tend to make the component purchaser's dollar worth more as time passed, in terms of electronic purchasing ability.

We have made no adjustments in the historical data to account for these inflationary and deflationary effects. The data are expressed in current dollars (dollars that include the inflation rate and exchange rates of the given year) for all historical data; comparisons between different years must be interpreted accordingly.

Average Selling Prices

When considering the worldwide average selling prices (ASPs) for semiconductor components, one must look at the price per function of a circuit, the complexity of the circuit, and the product mix according to this increasing complexity. It is true that one characteristic of the

semiconductor industry is that the price per function for integrated circuits has been dropping an average of 30 percent per year for the last 15 years. At the same time, circuits have become denser, resulting in an overall increase in the price of a device with a decreasing cost per function. Thus, Table 14 shows the worldwide ASPs increasing after many years of decreasing, due to the move toward higher-complexity devices. There are also regional differences in ASPs due to regional competition differences and the varying regional product consumption mix. The worldwide ASP is truly an aggregate measure and may differ significantly from ASPs in any specific market at any point in time.

Exchange Rates

Construction of the West European tables involves combining data from many countries, each of which has different and changing exchange rates. DATAQUEST uses Annual Foreign Exchange Rates for each year as published by The International Monetary Fund. As far as possible, we prepare our estimates in terms of local currencies before conversion to U.S. dollars. The exchange rates for major currencies can be found in Table 0 at the end of this introduction.

Japanese consumption and factory shipments are based on MITI data, which are originally expressed in yen. The Japanese data published in this study are expressed in both dollars (Tables 5, 6, and 19) and in yen (Tables 7, 8, and 20). The yen/dollar exchange rate used for each year can be found in Table 0. Because of the fluctuations in the exchange rate for the yen, the dollar values given tend to distort the growth rate of the Japanese market, but they do provide a useful basis for regional market size comparisons. However, the data in yen give a better picture of the real growth in the Japanese market.

FORECAST

As mentioned previously, historical data are expressed in current dollars or dollars that include the given year's inflation rate and exchange rates. However, the consumption forecasts, which appear in Tables 2, 4, 6, 8, 10, and 12, use constant dollars and exchange rates, with no allowance for inflation or variations in the rates of exchange between countries. All estimates for 1985 and beyond are made as if 1985 monetary conditions will continue through 1995 and, therefore, show the absolute year-to-year growth during this period.

Information on interregional trade and other analyses used in the preparation of these tables is available to DATAQUEST clients upon request.

Table 0

ANNUAL FOREIGN EXCHANGE RATES
(Expressed in U.S. Dollars)

Year	Japan (Dollars per Yen)	France (Dollars per French Franc)	West Germany (Dollars per Deutsche Mark)	United Kingdom (Dollars per Pound Sterling)
1970	$0.002795	$0.1808	$0.2740	$2.3810
1971	$0.002913	$0.1815	$0.2874	$2.4390
1972	$0.003311	$0.1984	$0.3135	$2.5000
1973	$0.003721	$0.2247	$0.3745	$2.4390
1974	$0.003427	$0.2079	$0.3861	$2.3256
1975	$0.003368	$0.2331	$0.4065	$2.2222
1976	$0.003376	$0.2092	$0.3968	$1.8182
1977	$0.003761	$0.2037	$0.4310	$1.7544
1978	$0.004857	$0.2217	$0.4975	$1.9231
1979	$0.004518	$0.2353	$0.5464	$2.1277
1980	$0.004449	$0.2364	$0.5495	$2.3256
1981	$0.004519	$0.1842	$0.4425	$1.0408
1982	$0.004022	$0.1522	$0.4115	$1.7544
1983	$0.004203	$0.1312	$0.3922	$1.4085
1984	$0.004219	$0.1144	$0.3509	$1.3333

Source: The International Monetary Fund
DATAQUEST

TABLE 1

HISTORICAL WORLDWIDE SEMICONDUCTOR CONSUMPTION
(Millions of Dollars)
1975 through 1984

	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	CAG % (75-84)
Total Semiconductor	4,396	5,872	6,848	8,829	10,995	13,933	14,568	15,029	19,176	28,676	23.2
Total Integrated Circuit	2,162	2,977	3,643	5,106	6,909	9,361	9,786	10,662	14,368	22,353	29.6
Bipolar Digital (Technology)	682	865	994	1,261	1,674	2,374	2,337	2,412	2,998	4,800	24.2
TTL	499	682	771	998	1,365	1,930	1,823	1,888	2,423	4,055	26.2
DTL	81	71	61	55	51	45	43	40	40	38	(8.1)
ECL	56	76	95	138	178	388	376	391	445	687	30.6
Other Bipolar Digital	47	36	67	78	88	99	95	92	90	100	8.8
Bipolar Digital (Function)	682	865	994	1,261	1,674	2,374	2,337	2,412	2,998	4,800	24.2
Bipolar Digital Memory					324	572	558	511	593	831	
Bipolar Digital Logic					1,350	1,802	1,779	1,901	2,405	3,969	
MOS (Technology)	837	1,239	1,584	2,332	3,346	4,715	4,822	5,642	8,013	12,967	35.6
NMOS	133	377	655	1,361	2,184	3,207	3,190	3,902	5,445	8,818	59.4
PMOS	609	658	613	574	497	503	451	376	361	373	(5.3)
CMOS	95	204	316	397	665	1,005	1,181	1,364	2,207	3,776	50.6
MOS (Function)	837	1,239	1,584	2,332	3,346	4,715	4,822	5,642	8,013	12,967	35.6
MOS Memory					1,676	2,230	2,075	2,701	3,891	6,163	
MOS Micro Devices					541	862	1,065	1,318	2,013	3,217	
MOS Logic					1,129	1,623	1,662	1,623	2,309	3,587	
Linear	643	873	1,065	1,513	1,889	2,272	2,627	2,888	3,357	4,586	24.4
Total Discrete	2,019	2,612	2,903	3,301	3,522	3,883	3,985	3,547	3,796	4,973	10.5
Transistor	1,048	1,351	1,460	1,625	1,696	1,841	2,019	1,791	1,914	2,461	9.9
Small Signal Transistor	629	805	800	892	891	938	1,096	953	1,002	1,297	8.4
Power Transistor	419	546	660	733	805	903	923	838	912	1,164	12.0
Diode	700	896	1,001	1,184	1,277	1,441	1,417	1,249	1,341	1,794	11.0
Small Signal Diode	207	281	311	370	437	478	454	393	417	539	11.2
Power Diode	394	496	563	663	688	786	771	685	749	993	10.8
Zener Diode	99	119	127	151	152	177	192	191	175	262	11.4
Thyristor	183	242	300	339	365	401	356	315	312	433	10.0
Other Discrete	88	123	142	153	184	200	193	192	229	285	13.9
Total Optoelectronic	215	283	302	422	564	689	797	820	1,012	1,350	22.6
LED Lamps	31	53	73	101	119	136	180	187	245	320	29.6
LED Displays	123	148	139	187	234	268	285	286	333	418	14.6
Optical Couplers	21	29	34	52	89	100	122	129	162	230	30.5
Other Optoelectronics	40	53	56	82	131	185	210	218	272	382	28.5

Source: DATAQUEST

TABLE 2

WORLDWIDE SEMICONDUCTOR CONSUMPTION FORECAST
(Millions of Dollars)
1983 through 1990, plus 1995

	1983	1984	1985	1986	1987	1988	1989	1990	CAG % (84-90)	1995	CAG % (90-95)
Total Semiconductor	19,176	28,676	25,532	30,251	39,632	49,556	50,788	60,727	13.3	157,135	20.9
Total Integrated Circuit	14,368	22,353	19,378	23,732	32,143	41,110	42,327	51,542	14.9	140,045	22.1
Bipolar Digital (Technology)	2,998	4,800	3,871	4,535	5,831	7,204	7,269	8,195	9.3	20,950	20.6
TTL	2,423	4,055									
DTL	40	38									
ECL	445	607									
Other Bipolar Digital	90	100									
Bipolar Digital (Function)	2,998	4,800	3,871	4,535	5,831	7,204	7,269	8,195	9.3	20,950	20.6
Bipolar Digital Memory	593	831	656	709	858	987	927	1,029	3.6	1,584	9.0
Bipolar Digital Logic	2,405	3,969	3,215	3,826	4,973	6,217	6,342	7,166	10.3	19,366	22.0
MOS (Technology)	8,013	12,967	11,659	14,348	20,348	26,867	27,881	35,379	18.2	103,753	24.0
NMOS	5,445	8,818	7,299	8,637	11,110	12,627	11,013	11,321	4.3	20,751	12.9
PMOS	361	373	254	201	283	188	112	106	(18.9)	104	(0.4)
CMOS	2,207	3,776	3,506	5,510	9,035	14,052	16,756	23,952	36.1	82,898	28.2
MOS (Function)	8,013	12,967	11,659	14,348	20,348	26,867	27,881	35,379	18.2	103,753	24.0
MOS Memory	3,691	6,163	4,931	6,607	9,646	13,118	12,200	15,128	16.1	48,044	26.0
MOS Micro Devices	2,013	3,217	2,883	3,893	5,319	7,074	8,285	10,831	22.4	28,093	21.0
MOS Logic	2,309	3,587	3,285	4,048	5,383	6,675	7,476	9,420	17.5	27,616	24.0
Linear	3,357	4,586	4,448	4,849	5,964	7,039	7,177	7,968	9.6	15,342	14.0
Total Discrete	3,796	4,973	4,824	5,885	5,773	6,465	6,482	6,859	5.5	11,833	10.0
Transistor	1,914	2,461	2,445	2,588	2,885	3,253	3,344	3,631	6.7	6,667	12.9
Small Signal Transistor	1,002	1,297	1,245	1,269	1,445	1,574	1,626	1,779	5.3	3,699	15.9
Power Transistor	912	1,164	1,200	1,240	1,440	1,679	1,718	1,861	8.1	2,968	9.8
Diode	1,341	1,794	1,715	1,844	2,067	2,278	2,171	2,286	4.1	3,889	6.2
Small Signal Diode	417	539	493	529	567	629	574	611	2.1	770	4.7
Power Diode	749	993	986	1,071	1,212	1,366	1,263	1,349	5.2	1,868	6.7
Zener Diode	175	262	236	253	288	341	334	326	3.7	451	6.7
Thyristor	312	433	385	411	459	514	457	442	0.3	529	3.7
Other Discrete	229	285	279	310	362	422	438	491	9.5	748	8.8
Total Optoelectronic	1,812	1,350	1,338	1,454	1,716	1,981	2,058	2,335	9.6	6,057	21.0
LED Lamps	245	320	310	329	372	412	413	487	7.2	1,263	21.0
LED Displays	333	418	418	447	519	586	588	643	7.4	1,537	19.0
Optical Couplers	162	230	228	255	309	364	397	456	12.1	1,233	22.0
Other Optoelectronics	272	382	374	423	516	619	669	749	11.9	2,024	22.0

Source: DATAQUEST

TABLE 3

HISTORICAL NORTH AMERICAN SEMICONDUCTOR CONSUMPTION
(Millions of Dollars)
1975 through 1984

	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	CAG % (75-84)
Total Semiconductor	1,758	2,313	2,756	3,382	4,419	5,868	6,269	6,738	8,779	13,443	25.4
Total Integrated Circuit	966	1,380	1,691	2,211	3,060	4,377	4,607	5,234	7,164	11,195	31.3
Bipolar Digital (Technology)	323	470	537	666	901	1,411	1,339	1,367	1,729	2,901	27.6
TTL											
DTL											
ECL											
Other Bipolar Digital											
Bipolar Digital (Function)	323	470	537	666	901	1,411	1,339	1,367	1,729	2,901	27.6
→ Bipolar Digital Memory					185	396	375	320	423	577	
→ Bipolar Digital Logic					716	1,015	964	1,047	1,306	2,324	
MOS (Technology)	419	640	830	1,099	1,703	2,442	2,595	3,183	4,416	6,891	36.5
NMOS											
PMOS											
CMOS											
MOS (Function)	419	640	830	1,099	1,703	2,442	2,595	3,183	4,416	6,891	36.5
→ MOS Memory					1,028	1,230	1,107	1,592	2,651	3,201	
→ MOS Micro Devices					186	377	489	641	1,068	1,764	
→ MOS Logic					489	835	999	950	1,297	1,926	
→ Linear	224	270	324	446	456	524	673	684	1,019	1,403	22.6
→ Total Discrete	664	789	940	1,085	1,161	1,289	1,398	1,221	1,296	1,883	11.7
Transistor	339	400	486	515	545	572	690	611	598	764	9.4
Small Signal Transistor	179	208	228	251	254	264	341	304	290	439	10.2
Power Transistor	160	192	258	264	291	308	349	307	308	334	8.5
Diode	223	265	295	310	417	483	484	434	502	732	14.1
Small Signal Diode	52	65	64	55	76	92	92	77	103	152	12.7
Power Diode	128	153	174	191	264	306	288	245	304	427	14.3
Zener Diode	43	47	57	64	77	85	104	112	95	153	15.1
Thyristor	60	83	115	130	139	159	154	129	134	213	15.1
Other Discrete	42	41	44	50	60	75	70	47	62	94	9.4
→ Total Optoelectronic	128	144	125	166	198	282	264	283	319	445	14.8
LED Lamps	13	15	24	32	28	20	42	39	57	109	26.7
LED Displays	86	90	62	81	75	83	71	74	65	81	(0.7)
Optical Couplers	13	17	19	24	42	48	70	71	86	126	28.7
Other Optoelectronics	16	22	20	29	53	71	81	99	111	129	26.1

Source: DATAQUEST

TABLE 2

WORLDWIDE SEMICONDUCTOR CONSUMPTION FORECAST
(Millions of Dollars)
1983 through 1990, plus 1995

	1983	1984	1985	1986	1987	1988	1989	1990	CAG % (84-90)	1995	CAG % (90-95)
Total Semiconductor	19,176	28,676	25,532	30,251	39,632	49,556	50,788	60,727	13.3	157,135	20.9
Total Integrated Circuit	14,368	22,353	19,378	23,732	32,143	41,110	42,327	51,542	14.9	140,045	22.1
Bipolar Digital (Technology)	2,998	4,800	3,871	4,535	5,831	7,204	7,269	8,195	9.3	20,950	20.6
TTL	2,423	4,055									
DTL	40	38									
ECL	445	607									
Other Bipolar Digital	90	100									
Bipolar Digital (Function)	2,998	4,800	3,871	4,535	5,831	7,204	7,269	8,195	9.3	20,950	20.6
Bipolar Digital Memory	593	831	656	709	858	987	927	1,029	3.6	1,584	9.0
Bipolar Digital Logic	2,405	3,969	3,215	3,826	4,973	6,217	6,342	7,166	10.3	19,366	22.0
MOS (Technology)	8,013	12,967	11,659	14,348	20,348	26,867	27,881	35,379	18.2	103,753	24.0
NMOS	5,445	8,818	7,299	8,637	11,110	12,627	11,013	11,321	4.3	20,751	12.9
PMOS	361	373	254	201	203	188	112	106	(18.9)	104	(0.4)
CMOS	2,207	3,776	3,506	5,510	9,035	14,052	16,756	23,952	36.1	82,898	28.2
MOS (Function)	8,013	12,967	11,659	14,348	20,348	26,867	27,881	35,379	18.2	103,753	24.0
MOS Memory	3,691	6,163	4,931	6,607	9,646	13,118	12,200	15,128	16.1	48,044	26.0
MOS Micro Devices	2,013	3,217	2,863	3,693	5,319	7,074	8,205	10,831	22.4	26,893	21.0
MOS Logic	2,309	3,587	3,265	4,048	5,383	6,675	7,476	9,420	17.5	27,816	24.0
Linear	3,357	4,586	4,448	4,849	5,964	7,039	7,177	7,968	9.6	15,342	14.0
Total Discrete	3,796	4,973	4,824	5,065	5,773	6,465	6,402	6,850	5.5	11,833	10.0
Transistor	1,914	2,461	2,445	2,500	2,885	3,253	3,344	3,631	6.7	6,667	12.9
Small Signal Transistor	1,002	1,297	1,245	1,260	1,445	1,574	1,626	1,770	5.3	3,099	15.9
Power Transistor	912	1,164	1,200	1,240	1,440	1,679	1,718	1,861	8.1	2,968	9.8
Diode	1,341	1,794	1,715	1,844	2,067	2,276	2,171	2,286	4.1	3,889	8.2
Small Signal Diode	417	539	493	520	567	629	574	611	2.1	770	4.7
Power Diode	749	993	986	1,071	1,212	1,306	1,263	1,349	5.2	1,868	6.7
Zener Diode	175	262	236	253	288	341	334	326	3.7	451	6.7
Thyristor	312	433	385	411	459	514	457	442	0.3	529	3.7
Other Discrete	229	285	279	310	362	422	430	491	9.5	748	8.8
Total Optoelectronic	1,012	1,350	1,330	1,454	1,716	1,961	2,059	2,335	9.6	6,057	21.0
LED Lamps	245	320	310	329	372	412	413	487	7.2	1,263	21.0
LED Displays	333	418	418	447	519	586	589	643	7.4	1,537	19.0
Optical Couplers	162	230	228	255	309	364	397	456	12.1	1,233	22.0
Other Optoelectronics	272	382	374	423	516	619	669	749	11.9	2,024	22.0

Source: DATAQUEST

TABLE 3

HISTORICAL NORTH AMERICAN SEMICONDUCTOR CONSUMPTION
(Millions of Dollars)
1975 through 1984

	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	CAG % (75-84)
Total Semiconductor	1,758	2,313	2,756	3,382	4,419	5,868	6,269	6,738	8,779	13,443	25.4
Total Integrated Circuit	966	1,380	1,691	2,211	3,060	4,377	4,607	5,234	7,164	11,195	31.3
Bipolar Digital (Technology)	323	470	537	666	901	1,411	1,339	1,367	1,729	2,901	27.6
TTL											
DTL											
ECL											
Other Bipolar Digital											
Bipolar Digital (Function)	323	470	537	666	901	1,411	1,339	1,367	1,729	2,901	27.6
Bipolar Digital Memory					185	396	375	320	423	577	
Bipolar Digital Logic					716	1,015	964	1,047	1,306	2,324	
MOS (Technology)	419	640	830	1,099	1,703	2,442	2,595	3,183	4,416	6,891	36.5
NMOS											
PMOS											
CMOS											
MOS (Function)	419	640	830	1,099	1,703	2,442	2,595	3,183	4,416	6,891	36.5
MOS Memory					1,028	1,230	1,107	1,592	2,851	3,201	
MOS Micro Devices					186	377	489	641	1,068	1,764	
MOS Logic					489	835	999	950	1,297	1,926	
Linear	224	270	324	446	456	524	673	684	1,019	1,403	22.6
Total Discrete	664	789	940	1,005	1,161	1,289	1,398	1,221	1,296	1,883	11.7
Transistor	339	400	486	515	545	572	690	611	598	764	9.4
Small Signal Transistor	179	208	228	251	254	264	341	304	290	430	10.2
Power Transistor	160	192	258	264	291	308	349	307	308	334	8.5
Diode	223	265	295	310	417	483	484	434	582	732	14.1
Small Signal Diode	52	65	64	55	76	92	92	77	103	152	12.7
Power Diode	128	153	174	191	264	306	288	245	304	427	14.3
Zener Diode	43	47	57	64	77	85	104	112	95	153	15.1
Thyristor	60	83	115	130	139	159	154	129	134	213	15.1
Other Discrete	42	41	44	50	60	75	70	47	62	94	9.4
Total Optoelectronic	128	144	125	166	198	282	284	283	319	445	14.8
LED Lamps	13	15	24	32	28	20	42	39	57	109	26.7
LED Displays	86	98	62	81	75	63	71	74	65	81	(0.7)
Optical Couplers	13	17	19	24	42	48	70	71	86	126	28.7
Other Optoelectronics	16	22	28	29	53	71	81	99	111	129	26.1

Source: DATAQUEST

TABLE 4

NORTH AMERICAN SEMICONDUCTOR CONSUMPTION FORECAST
(Millions of Dollars)
1983 through 1990, plus 1995

	1983	1984	1985	1986	1987	1988	1989	1990	CAG % (84-90)	1995	CAG % (90-95)
Total Semiconductor	8,779	13,443	10,719	12,910	17,361	21,658	21,941	26,128	11.7	64,966	20.0
Total Integrated Circuit	7,164	11,195	8,691	10,780	14,609	18,530	18,792	22,655	12.5	58,444	20.9
Bipolar Digital (Technology)	1,729	2,901	2,145	2,510	3,234	3,971	3,960	4,412	7.2	10,613	19.2
TTL											
DTL											
ECL											
Other Bipolar Digital											
Bipolar Digital (Function)	1,729	2,901	2,145	2,510	3,234	3,971	3,960	4,412	7.2	10,613	19.2
Bipolar Digital Memory	423	577	392	414	507	575	537	586	0.3	839	7.4
Bipolar Digital Logic	1,306	2,324	1,753	2,096	2,727	3,396	3,423	3,824	8.7	9,774	20.6
MOS (Technology)	4,416	6,891	5,358	7,032	9,846	12,754	13,086	16,231	15.3	44,110	22.1
NMOS											
PMOS											
CMOS											
MOS (Function)	4,416	6,891	5,358	7,032	9,846	12,754	13,086	16,231	15.3	44,110	22.1
MOS Memory	2,051	3,281	2,399	3,278	4,750	6,316	5,793	7,093	14.2	21,229	24.5
MOS Micro Devices	1,068	1,764	1,334	1,741	2,436	3,166	3,616	4,635	17.5	10,958	18.8
MOS Logic	1,297	1,926	1,625	2,013	2,660	3,270	3,597	4,503	15.2	11,923	21.5
Linear	1,019	1,403	1,188	1,238	1,529	1,805	1,826	2,012	6.2	3,721	13.1
Total Discrete	1,296	1,883	1,626	1,688	2,196	2,489	2,481	2,710	7.0	4,393	10.1
Transistor	596	764	698	745	1,000	1,142	1,202	1,342	9.8	2,658	14.6
Small Signal Transistor	290	430	373	370	478	541	582	672	7.7	1,600	18.9
Power Transistor	306	334	325	375	522	601	620	670	12.3	1,058	9.6
Diode	502	732	673	682	872	971	929	969	5.1	1,269	5.1
Small Signal Diode	103	152	147	143	189	226	205	224	6.7	262	3.2
Power Diode	304	427	397	404	521	548	528	574	5.1	741	5.2
Zener Diode	95	153	129	135	162	197	196	191	3.8	266	6.8
Thyristor	134	213	172	177	209	234	201	192	(1.7)	196	0.4
Other Discrete	62	94	83	84	115	142	149	187	12.1	270	7.6
Total Optoelectronic	319	445	402	442	556	639	668	763	9.4	2,129	22.8
LED Lamps	57	109	102	112	136	150	150	176	8.3	450	20.7
LED Displays	65	81	87	97	103	114	111	121	6.9	277	18.0
Optical Couplers	86	126	117	125	147	172	188	216	9.4	563	21.1
Other Optoelectronics	111	129	96	108	170	203	219	250	11.7	839	27.4

Source: DATAQUEST

TABLE 5

HISTORICAL JAPANESE SEMICONDUCTOR CONSUMPTION
(Millions of Dollars)
1975 through 1984

	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	CAG % (75-84)
Total Semiconductor	1,000	1,632	1,723	2,448	2,768	3,383	4,295	4,002	5,566	8,355	25.5
Total Integrated Circuit	545	787	864	1,399	1,738	2,201	2,793	2,855	3,952	6,161	30.9
Bipolar Digital (Technology)	140	174	190	259	304	345	438	498	624	936	23.5
TTL											
DTL											
ECL											
Other Bipolar Digital											
Bipolar Digital (Function)	140	174	190	259	304	345	438	498	624	936	23.5
Bipolar Digital Memory					52	57	77	87	59	99	
Bipolar Digital Logic					252	288	361	411	565	837	
MOS (Technology)	216	306	314	588	762	991	1,174	1,263	1,920	3,263	35.2
NMOS											
PMOS											
CMOS											
MOS (Function)	216	306	314	588	762	991	1,174	1,263	1,920	3,263	35.2
MOS Memory					256	423	491	534	865	1,639	
MOS Micro Devices					213	269	404	446	594	822	
MOS Logic					293	299	279	283	461	802	
Linear	189	307	360	552	672	865	1,181	1,094	1,408	1,962	29.7
Total Discrete	510	801	792	946	889	986	1,237	970	1,232	1,671	14.1
Transistor	296	459	431	483	448	488	656	503	674	909	13.3
Small Signal Transistor	180	305	275	299	268	290	391	252	334	485	9.4
Power Transistor	116	154	156	184	172	198	265	251	340	504	17.7
Diode	159	251	259	348	322	367	455	361	443	603	16.0
Small Signal Diode	67	81	77	96	86	110	177	150	180	242	15.3
Power Diode	75	148	158	222	204	217	234	180	226	311	17.1
Zener Diode	17	22	23	30	32	40	44	31	37	50	12.7
Thyristor	32	52	57	63	72	74	62	48	59	69	8.9
Other Discrete	23	39	45	52	55	57	64	56	65	90	16.4
Total Optoelectronic	25	44	67	103	141	196	265	257	382	523	40.2
LED Lamps	4	8	7	16	21	32	58	71	107	114	45.1
LED Displays	11	24	36	47	63	89	111	99	147	192	37.4
Optical Couplers	2	4	6	10	13	17	19	22	34	48	42.3
Other Optoelectronics	8	8	18	30	44	58	77	65	94	169	40.3

Source: DATAQUEST

TABLE 6

JAPANESE SEMICONDUCTOR CONSUMPTION FORECAST
(Millions of Dollars)
1983 through 1990, plus 1995

	1983	1984	1985	1986	1987	1988	1989	1990	CAG % (84-90)	1995	CAG % (90-95)
Total Semiconductor	5,566	8,355	8,089	9,485	12,203	15,323	15,830	19,146	14.8	51,366	21.8
Total Integrated Circuit	3,952	6,161	5,859	7,138	9,724	12,570	13,052	16,073	17.3	45,582	23.2
Bipolar Digital (Technology)	624	936	824	975	1,271	1,582	1,623	1,872	12.2	5,194	22.6
TTL											
DTL											
ECL											
Other Bipolar Digital											
Bipolar Digital (Function)	624	936	824	975	1,271	1,582	1,623	1,872	12.2	5,194	22.6
Bipolar Digital Memory	59	99	96	100	132	158	152	174	9.9	314	12.5
Bipolar Digital Logic	565	837	728	875	1,139	1,424	1,471	1,698	12.5	4,880	23.5
MOS (Technology)	1,920	3,263	3,081	4,040	5,841	7,919	8,307	10,735	22.0	33,745	25.7
NMOS											
PMOS											
CMOS											
MOS (Function)	1,920	3,263	3,081	4,040	5,841	7,919	8,307	10,735	22.0	33,745	25.7
MOS Memory	865	1,639	1,464	1,995	2,981	4,198	3,965	4,992	20.4	16,815	27.5
MOS Micro Devices	594	822	854	1,100	1,622	2,186	2,593	3,520	27.4	9,833	22.8
MOS Logic	461	802	763	945	1,238	1,535	1,749	2,223	18.5	7,097	26.1
Linear	1,408	1,962	1,954	2,123	2,612	3,069	3,122	3,466	9.9	6,643	13.9
Total Discrete	1,232	1,671	1,679	1,750	1,807	1,972	1,965	2,158	4.4	3,520	10.3
Transistor	674	909	951	915	966	1,070	1,101	1,214	4.9	2,239	13.0
Small Signal Transistor	334	405	421	421	430	454	468	521	4.3	1,101	16.1
Power Transistor	340	504	530	494	536	616	633	693	5.5	1,138	10.4
Diode	443	603	573	656	655	694	662	721	3.0	952	5.7
Small Signal Diode	180	242	201	228	224	240	220	246	0.3	311	4.8
Power Diode	226	311	322	370	373	387	376	411	4.8	548	5.9
Zener Diode	37	50	50	58	58	67	66	64	4.2	93	7.8
Thyristor	50	69	64	73	74	81	72	71	0.5	73	0.6
Other Discrete	65	90	91	106	112	127	130	152	9.1	256	11.0
Total Optoelectronic	382	523	551	597	672	781	813	915	9.8	2,264	19.9
LED Lamps	107	114	115	120	128	142	143	169	6.8	447	21.5
LED Displays	147	192	195	205	247	281	280	312	8.4	772	19.9
Optical Couplers	34	48	47	54	67	79	87	100	13.0	296	24.2
Other Optoelectronics	94	169	194	218	230	279	303	334	12.0	749	17.5

Source: DATAQUEST

TABLE 7

HISTORICAL JAPANESE SEMICONDUCTOR CONSUMPTION
(Billions of Yen)
1975 through 1984

	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	CAG % (75-84)
Total Semiconductor	320.8	483.1	463.5	514.1	606.2	767.9	949.2	1,012.3	1,306.0	1,980.1	22.4
Total Integrated Circuit	161.9	233.0	232.4	293.8	380.6	499.6	617.3	708.0	928.7	1,460.2	27.7
Bipolar Digital (Technology)	41.6	51.5	51.1	54.4	66.6	78.3	96.8	123.5	146.6	221.8	20.4
TTL											
DTL											
ECL											
Other Bipolar Digital											
Bipolar Digital (Function)	41.6	51.5	51.1	54.4	66.6	78.3	96.8	123.5	146.6	221.8	20.4
Bipolar Digital Memory					11.4	12.9	17.0	21.6	13.9	23.5	
Bipolar Digital Logic					55.2	65.4	79.8	101.9	132.8	198.4	
MOS (Technology)	64.2	90.6	84.5	123.5	166.9	225.0	259.5	313.2	451.2	773.3	31.9
NMOS											
PMOS											
CMOS											
MOS (Function)	64.2	90.6	84.5	123.5	166.9	225.0	259.5	313.2	451.2	773.3	31.9
MOS Memory					56.1	96.0	108.5	132.4	203.3	388.4	
MOS Microprocessor					46.6	61.1	69.3	110.6	139.6	194.8	
MOS Logic					64.2	67.9	81.7	70.2	108.3	190.1	
Linear	56.1	90.9	96.8	115.9	147.2	196.4	261.0	271.3	330.9	465.0	26.5
Total Discrete	151.5	237.1	213.0	198.7	194.7	223.8	273.4	240.6	289.5	396.0	11.3
Transistor	87.9	135.9	115.9	101.4	96.4	110.8	145.0	124.7	156.4	215.4	10.5
Small Signal Transistor	53.5	90.3	74.0	62.8	58.7	65.8	86.4	62.5	78.5	96.0	6.7
Power Transistor	34.5	45.6	42.0	38.6	37.7	44.9	58.6	62.2	79.9	119.4	14.8
Diode	47.2	74.3	69.7	73.1	70.5	83.3	100.8	89.5	104.1	142.9	13.1
Small Signal Diode	19.9	24.0	20.7	20.2	18.8	25.0	39.1	37.2	42.3	57.4	12.5
Power Diode	22.3	43.8	42.8	46.6	44.7	49.3	51.7	44.6	53.1	73.7	14.2
Zener Diode	5.0	6.5	6.2	6.3	7.0	9.1	9.7	7.7	8.7	11.9	9.9
Thyristor	9.5	15.4	15.3	13.2	15.8	16.8	13.7	11.9	11.8	16.4	6.2
Other Discrete	6.8	11.5	12.1	10.9	12.0	12.9	14.1	14.4	15.3	21.3	13.5
Total Optoelectronic	7.4	13.0	18.0	21.6	30.9	44.5	58.6	63.7	89.8	124.0	36.7
LED Lamps	1.2	2.4	1.9	3.4	4.6	7.3	12.8	17.6	25.1	27.0	41.5
LED Displays	3.3	7.1	9.7	9.9	13.8	20.2	24.5	24.6	34.5	45.5	34.0
Optical Couplers	0.6	1.2	1.6	2.1	2.8	3.9	4.2	5.5	8.0	11.4	38.8
Other Optoelectronics	2.4	2.4	4.8	6.3	9.6	13.2	17.0	16.1	22.1	40.1	36.9
Exchange Rate (Yen/US$)	297.0	296.0	269.0	210.0	219.0	227.0	221.0	248.0	235.0	237.0	(2.5)

Source: DATAQUEST

TABLE 8

JAPANESE SEMICONDUCTOR CONSUMPTION FORECAST
(Billions of Yen)
1983 through 1990, plus 1995

	1983	1984	1985	1986	1987	1988	1989	1990	CAG % (84-90)	1995	CAG % (90-95)
Total Semiconductor	1,308.0	1,980.1	1,917.1	2,247.9	2,892.1	3,631.6	3,751.7	4,537.6	14.8	12,173.7	21.8
Total Integrated Circuit	928.7	1,460.2	1,388.6	1,691.7	2,304.6	2,979.1	3,093.3	3,809.3	17.3	10,882.9	23.2
Bipolar Digital (Technology)	146.6	221.8	195.3	231.1	301.2	374.9	384.7	443.7	12.2	1,231.0	22.6
TTL											
DTL											
ECL											
Other Bipolar Digital											
Bipolar Digital (Function)	146.6	221.8	195.3	231.1	301.2	374.9	384.7	443.7	12.2	1,231.0	22.6
Bipolar Digital Memory	13.9	23.5	22.8	23.7	31.3	37.4	36.0	41.2	9.9	74.4	12.5
Bipolar Digital Logic	132.8	198.4	172.5	207.4	269.9	337.5	348.6	402.4	12.5	1,156.6	23.5
MOS (Technology)	451.2	773.3	730.2	957.5	1,384.3	1,876.8	1,968.8	2,544.2	22.0	7,997.6	25.7
NMOS											
PMOS											
CMOS											
MOS (Function)	451.2	773.3	730.2	957.5	1,384.3	1,876.8	1,968.8	2,544.2	22.0	7,997.6	25.7
MOS Memory	203.3	388.4	347.0	472.8	706.5	994.9	939.7	1,183.1	20.4	3,985.2	27.5
MOS Microprocessor	139.6	194.8	202.4	260.7	384.4	518.1	614.5	834.2	27.4	2,330.4	22.8
MOS Logic	108.3	190.1	180.8	224.0	293.4	363.8	414.5	526.9	18.5	1,682.0	26.1
Linear	330.9	465.0	463.1	583.2	619.0	727.4	739.9	821.4	9.9	1,574.4	13.9
Total Discrete	289.5	396.0	397.9	414.8	428.3	467.4	465.7	511.4	4.4	834.2	10.3
Transistor	158.4	215.4	225.4	216.9	228.9	253.6	260.9	287.7	4.9	530.6	13.0
Small Signal Transistor	78.5	96.0	99.8	99.8	101.9	107.6	110.9	123.5	4.3	260.9	16.1
Power Transistor	79.9	119.4	125.6	117.1	127.0	146.0	150.0	164.2	5.5	269.7	10.4
Diode	104.1	142.9	135.8	155.5	155.2	164.5	156.9	170.9	3.0	225.6	5.7
Small Signal Diode	42.3	57.4	47.6	54.0	53.1	56.9	52.1	58.3	0.3	73.7	4.8
Power Diode	53.1	73.7	76.3	87.7	88.4	91.7	89.1	97.4	4.8	129.9	5.9
Zener Diode	8.7	11.9	11.9	13.7	13.7	15.9	15.6	15.2	4.2	22.0	7.8
Thyristor	11.8	16.4	15.2	17.3	17.5	19.2	17.1	16.8	0.5	17.3	0.6
Other Discrete	15.3	21.3	21.6	25.1	26.5	30.1	30.8	36.0	9.1	60.7	11.0
Total Optoelectronic	89.8	124.0	130.6	141.5	159.3	185.1	192.7	216.9	9.8	536.6	19.9
LED Lamps	25.1	27.0	27.3	28.4	30.3	33.7	33.9	40.1	6.8	105.9	21.5
LED Displays	34.5	45.5	46.2	48.6	58.5	66.6	66.4	73.9	8.4	183.0	19.9
Optical Couplers	8.0	11.4	11.1	12.8	15.9	18.7	20.6	23.7	13.0	70.2	24.2
Other Optoelectronics	22.1	40.1	46.0	51.7	54.5	66.1	71.8	79.2	12.0	177.5	17.5
Exchange Rate (Yen/US$)	235.0	237.0	237.0	237.0	237.0	237.0	237.0	237.0		237.0	

Source: DATAQUEST

TABLE 9

HISTORICAL WESTERN EUROPEAN SEMICONDUCTOR CONSUMPTION
(Millions of Dollars)
1975 through 1984

	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	CAG % (75-84)
Total Semiconductor	1,333	1,594	1,886	2,339	3,018	3,686	3,041	3,167	3,370	4,805	15.3
Total Integrated Circuit	561	676	904	1,238	1,747	2,333	1,892	1,988	2,323	3,634	23.1
Bipolar Digital (Technology)	189	186	228	291	390	510	454	434	483	724	16.1
TTL											
DTL											
ECL											
Other Bipolar Digital											
Bipolar Digital (Function)	189	186	228	291	390	510	454	434	483	724	16.1
Bipolar Digital Memory					85	116	103	100	107	149	
Bipolar Digital Logic					305	394	351	334	376	575	
MOS (Technology)	158	226	352	535	781	1,139	882	948	1,227	2,092	33.2
NMOS											
PMOS											
CMOS											
MOS (Function)	158	226	352	535	781	1,139	882	948	1,227	2,092	33.2
MOS Memory					367	543	426	469	581	995	
MOS Micro Devices					125	189	149	168	239	465	
MOS Logic					289	407	307	311	407	632	
Linear	214	264	324	412	576	684	556	606	613	818	16.1
Total Discrete	728	851	914	1,004	1,138	1,192	995	1,011	866	963	3.2
Transistor	351	400	424	463	511	511	463	468	408	450	2.8
Small Signal Transistor	243	248	244	265	286	275	251	247	210	223	(0.9)
Power Transistor	108	152	180	198	225	236	212	221	198	227	8.6
Diode	282	318	352	402	460	503	384	391	327	358	2.7
Small Signal Diode	72	117	143	182	228	225	157	154	125	132	7.0
Power Diode	173	163	176	184	194	231	192	202	174	193	1.2
Zener Diode	37	38	33	36	38	47	35	35	28	33	(1.3)
Thyristor	82	99	105	110	118	133	103	105	91	103	2.6
Other Discrete	13	34	33	29	49	45	45	47	40	52	16.7
Total Optoelectronic	44	67	68	97	133	161	154	168	181	288	18.8
LED Lamps	10	23	27	35	42	41	41	44	45	55	20.9
LED Displays	17	22	26	41	54	58	57	65	66	70	17.0
Optical Couplers	5	5	6	10	19	27	27	28	32	40	26.0
Other Optoelectronics	12	17	9	11	18	35	29	31	38	43	15.2

Source: DATAQUEST

TABLE 10

WESTERN EUROPEAN SEMICONDUCTOR CONSUMPTION FORECAST
(Millions of Dollars)
1983 through 1990, plus 1995

	1983	1984	1985	1986	1987	1988	1989	1990	CAG % (84-90)	1995	CAG % (90-95)
Total Semiconductor	3,370	4,805	4,900	5,685	7,149	8,887	9,178	10,940	14.7	28,444	21.1
Total Integrated Circuit	2,323	3,634	3,676	4,379	5,801	7,414	7,755	9,475	17.3	26,160	22.5
Bipolar Digital (Technology)	483	724	716	829	1,031	1,270	1,285	1,451	12.3	3,773	21.1
TTL											
DTL											
ECL											
Other Bipolar Digital											
Bipolar Digital (Function)	483	724	716	829	1,031	1,270	1,285	1,451	12.3	3,773	21.1
Bipolar Digital Memory	107	149	163	189	212	246	231	259	9.7	417	10.0
Bipolar Digital Logic	376	575	553	640	819	1,024	1,054	1,192	12.9	3,356	23.0
MOS (Technology)	1,227	2,092	2,038	2,562	3,562	4,648	4,944	6,315	20.2	19,897	24.8
NMOS											
PMOS											
CMOS											
MOS (Function)	1,227	2,092	2,038	2,562	3,562	4,648	4,944	6,315	20.2	19,897	24.8
MOS Memory	581	995	822	1,003	1,404	1,909	1,795	2,226	14.4	7,069	26.0
MOS Micro Devices	239	465	534	661	958	1,303	1,512	2,026	27.8	5,476	22.0
MOS Logic	407	632	682	838	1,140	1,436	1,637	2,063	21.8	6,552	26.0
Linear	613	818	922	1,048	1,268	1,496	1,526	1,709	13.1	3,290	14.0
Total Discrete	866	963	996	1,056	1,077	1,163	1,165	1,165	2.3	1,410	5.0
Transistor	406	450	467	489	499	539	515	519	2.4	639	4.2
Small Signal Transistor	210	223	222	224	227	239	213	212	(0.8)	170	(4.3)
Power Transistor	198	227	245	265	272	300	302	307	5.2	469	8.8
Diode	327	358	369	396	404	437	412	408	2.2	512	4.6
Small Signal Diode	125	132	132	134	135	139	125	117	(2.0)	106	(2.0)
Power Diode	174	193	203	226	232	257	248	250	4.4	359	7.5
Zener Diode	28	33	34	36	37	41	39	41	3.7	47	2.8
Thyristor	91	103	107	113	115	124	117	120	2.6	169	9.5
Other Discrete	40	52	53	58	59	63	61	58	1.8	70	3.8
Total Optoelectronic	181	208	228	259	271	310	318	360	9.6	874	19.4
LED Lamps	45	55	53	54	56	61	60	70	4.1	174	20.0
LED Displays	66	70	76	80	76	84	82	90	4.3	181	15.0
Optical Couplers	32	40	49	58	71	84	90	103	17.1	267	21.0
Other Optoelectronics	38	43	50	58	68	81	86	97	14.5	252	21.0

Source: DATAQUEST

TABLE 11

HISTORICAL REST OF WORLD SEMICONDUCTOR CONSUMPTION
(Millions of Dollars)
1975 through 1984

	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	CAG % (75-84)
Total Semiconductor	225	333	483	660	790	996	963	1,042	1,461	2,073	28.0
Total Integrated Circuit	90	134	184	258	364	450	494	585	929	1,363	35.3
Bipolar Digital (Technology)	30	35	39	45	79	108	106	113	162	239	25.9
TTL											
DTL											
ECL											
Other Bipolar Digital											
Bipolar Digital (Function)	30	35	39	45	79	108	106	113	162	239	25.9
Bipolar Digital Memory					2	3	3	4	4	6	
Bipolar Digital Logic					77	105	103	109	158	233	
MOS (Technology)	44	67	88	110	100	143	171	248	450	721	36.4
NMOS											
PMOS											
CMOS											
MOS (Function)	44	67	88	110	100	143	171	248	450	721	36.4
MOS Memory					25	34	51	105	194	328	
MOS Micro Devices					17	27	43	63	112	166	
MOS Logic					58	82	77	79	144	227	
Linear	16	32	57	103	185	199	217	224	317	403	43.1
Total Discrete	117	171	257	346	334	416	355	345	402	536	18.4
Transistor	62	92	119	164	200	270	210	209	234	338	20.7
Small Signal Transistor	27	44	53	77	83	109	113	150	168	239	27.4
Power Transistor	35	48	66	87	117	161	97	59	66	99	12.2
Diode	36	62	95	124	78	88	94	63	69	101	12.1
Small Signal Diode	16	18	27	37	47	51	28	12	9	13	(2.3)
Power Diode	18	32	54	66	26	32	57	38	45	62	14.7
Zener Diode	2	12	14	21	5	5	9	13	15	26	33.0
Thyristor	9	8	23	36	36	35	37	33	37	48	20.4
Other Discrete	10	9	20	22	20	23	14	40	62	49	19.3
Total Optoelectronic	18	28	42	56	92	130	114	112	130	174	28.7
LED Lamps	4	7	15	18	28	43	39	33	36	42	29.9
LED Displays	9	12	15	18	42	58	46	48	55	75	26.6
Optical Couplers	1	3	3	8	6	8	6	8	10	16	36.1
Other Optoelectronics	4	6	9	12	16	21	23	23	29	41	29.5

Source: DATAQUEST

TABLE 12

REST OF WORLD SEMICONDUCTOR CONSUMPTION FORECAST
(Millions of Dollars)
1983 through 1990, plus 1995

	1983	1984	1985	1986	1987	1988	1989	1990	CAG % (84-90)	1995	CAG % (90-95)
Total Semiconductor	1,461	2,073	1,824	2,171	2,919	3,688	3,839	4,513	13.8	12,359	22.3
Total Integrated Circuit	929	1,363	1,152	1,435	2,009	2,596	2,728	3,339	16.1	9,859	24.2
Bipolar Digital (Technology)	162	239	186	221	295	381	401	460	11.5	1,370	24.4
TTL											
DTL											
ECL											
Other Bipolar Digital											
Bipolar Digital (Function)	162	239	186	221	295	381	401	460	11.5	1,370	24.4
Bipolar Digital Memory	4	6	5	6	7	8	7	8	4.9	14	11.8
Bipolar Digital Logic	158	233	181	215	288	373	394	452	11.7	1,356	24.6
MOS (Technology)	450	721	582	774	1,159	1,546	1,624	2,096	19.5	6,881	26.5
NMOS											
PMOS											
CMOS											
MOS (Function)	450	721	582	774	1,159	1,546	1,624	2,096	19.5	6,881	26.5
MOS Memory	194	328	246	331	511	695	647	817	16.4	2,931	29.1
MOS Micro Devices	112	166	141	191	303	417	484	650	25.5	1,826	22.9
MOS Logic	144	227	195	252	345	434	493	631	18.6	2,044	26.5
Linear	317	403	384	440	555	669	703	781	11.7	1,688	16.7
Total Discrete	402	536	523	571	693	841	851	877	8.6	1,710	14.3
Transistor	234	338	329	351	420	502	526	556	8.6	1,131	15.3
Small Signal Transistor	168	239	229	245	310	340	363	365	7.3	828	17.8
Power Transistor	66	99	100	106	110	162	163	191	11.6	303	9.7
Diode	69	101	100	110	136	174	168	168	8.9	356	16.2
Small Signal Diode	9	13	13	15	19	24	24	24	10.8	91	30.5
Power Diode	45	62	64	71	86	114	111	114	10.7	220	14.1
Zener Diode	15	26	23	24	31	36	33	30	2.4	45	8.4
Thyristor	37	48	42	48	61	75	67	59	3.5	71	3.8
Other Discrete	62	49	52	62	76	90	90	94	11.5	152	10.1
Total Optoelectronic	130	174	149	165	217	251	260	297	9.3	790	21.6
LED Lamps	36	42	40	43	52	59	60	72	9.4	192	21.7
LED Displays	55	75	60	65	93	107	107	120	8.1	307	20.7
Optical Couplers	10	16	15	18	24	29	32	37	15.0	107	23.7
Other Optoelectronics	29	41	34	39	48	56	61	68	8.8	184	22.0

Source: DATAQUEST

TABLE 13

HISTORICAL WORLDWIDE AVERAGE SELLING PRICES
(Dollars)
1975 through 1984

	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	CAG % (75-84)
Total Semiconductor	0.30	0.29	0.28	0.29	0.29	0.32	0.31	0.33	0.33	0.36	2.0
Total Integrated Circuit	1.00	1.00	1.02	1.02	0.97	1.07	1.03	1.02	1.05	1.11	1.2
Bipolar Digital (Technology)	0.60	0.61	0.66	0.63	0.57	0.70	0.70	0.62	0.65	0.65	0.9
TTL											
DTL											
ECL											
Other Bipolar Digital											
Bipolar Digital (Function)	0.60	0.61	0.66	0.63	0.57	0.70	0.70	0.62	0.65	0.65	0.9
Bipolar Digital Memory											
Bipolar Digital Logic											
MOS (Technology)	2.75	2.39	2.06	1.91	1.93	1.81	1.67	1.71	1.72	1.96	(3.7)
NMOS	4.43	4.71	4.46	4.46	3.66	3.08	3.06	2.91	3.15	3.68	(2.0)
PMOS	4.01	4.18	3.01	1.92	1.80	1.75	1.70	1.70	1.75	1.75	(8.8)
CMOS	0.78	0.73	0.76	0.64	0.77	0.79	0.74	0.79	0.81	0.95	2.2
MOS (Function)	2.75	2.39	2.06	1.91	1.93	1.81	1.67	1.71	1.72	1.96	(3.7)
MOS Memory					5.10	4.95	3.22	3.09	3.25	3.75	
MOS Micro Devices					3.96	3.61	3.40	3.34	3.40	4.35	
MOS Logic					0.89	0.85	0.86	0.80	0.79	0.85	
Linear	0.90	0.85	0.83	0.84	0.78	0.83	0.81	0.79	0.76	0.75	(2.0)
Total Discrete	0.16	0.15	0.14	0.13	0.12	0.12	0.11	0.11	0.09	0.09	(6.4)
Transistor	0.22	0.19	0.19	0.18	0.17	0.16	0.15	0.13	0.12	0.10	(8.2)
Small Signal Transistor	0.15	0.13	0.12	0.11	0.10	0.09	0.09	0.08	0.07	0.06	(9.7)
Power Transistor	0.68	0.73	0.78	0.73	0.70	0.68	0.56	0.54	0.49	0.41	(5.5)
Diode	0.10	0.09	0.08	0.08	0.07	0.07	0.07	0.07	0.06	0.06	(4.8)
Small Signal Diode	0.05	0.05	0.04	0.04	0.04	0.04	0.04	0.04	0.03	0.03	(5.5)
Power Diode	0.15	0.14	0.14	0.13	0.12	0.11	0.10	0.09	0.09	0.11	(3.4)
Zener Diode	0.17	0.15	0.15	0.18	0.11	0.14	0.14	0.13	0.12	0.11	(4.7)
Thyristor	0.83	0.89	0.92	0.91	0.89	0.98	1.09	0.95	0.92	0.68	(2.2)
Other Discrete	1.01	0.88	0.72	0.63	0.33	0.26	0.26	0.23	0.23	0.20	(16.5)
Total Optoelectronic	0.86	0.67	0.45	0.47	0.51	0.44	0.39	0.38	0.36	0.34	(9.8)
LED Lamps					0.18	0.13	0.12	0.12	0.12	0.11	
LED Displays					1.40	1.45	1.50	1.38	1.37	1.35	
Optical Couplers					0.79	0.83	0.77	0.70	0.66	0.62	
Other Optoelectronics					0.72	0.90	1.07	1.11	1.07	1.01	

Source: DATAQUEST

TABLE 14

WORLDWIDE AVERAGE SELLING PRICES FORECAST
(Dollars)
1983 through 1990, plus 1995

	1983	1984	1985	1986	1987	1988	1989	1990	CAG % (84-90)	1995	CAG % (90-95)
Total Semiconductor	0.33	0.36	0.28	0.31	0.35	0.36	0.37	0.41	2.1	0.50	4.3
Total Integrated Circuit	1.05	1.11	1.06	1.13	1.21	1.31	1.28	1.36	3.4	1.66	4.1
Bipolar Digital (Technology)	0.65	0.65	0.65	0.66	0.70	0.75	0.76	0.80	3.5	0.95	3.5
TTL											
DTL											
ECL											
Other Bipolar Digital											
Bipolar Digital (Function)	0.65	0.65	0.65	0.66	0.70	0.75	0.76	0.80	3.5	0.95	3.5
Bipolar Digital Memory											
Bipolar Digital Logic											
MOS (Technology)	1.72	1.96	1.80	1.92	2.03	2.17	2.00	2.06	0.8	2.38	2.9
NMOS	3.15	3.68	3.20	3.20	3.21	3.21	3.22	3.22	(2.2)	3.28	0.4
PMOS	1.75	1.75	1.75	1.75	1.76	1.76	1.76	1.76	0.1	1.79	0.3
CMOS	0.81	0.95	0.94	1.18	1.40	1.69	1.60	1.76	10.9	2.23	4.8
MOS (Function)	1.72	1.96	1.80	1.92	2.03	2.17	2.00	2.06	0.8	2.38	2.9
MOS Memory	3.25	3.75	2.74	2.92	3.03	3.19	2.65	2.85	(4.5)	3.15	2.0
MOS Micro Devices	3.40	4.35	3.56	3.29	3.11	2.94	2.78	2.58	(8.3)	2.43	(1.2)
MOS Logic	0.79	0.85	0.92	0.99	1.05	1.14	1.17	1.23	6.4	1.65	6.1
Linear	0.76	0.75	0.73	0.72	0.72	0.74	0.75	0.75		0.81	1.6
Total Discrete	0.09	0.09	0.07	0.07	0.07	0.07	0.07	0.07	(4.9)	0.05	(4.2)
Transistor	0.12	0.10	0.09	0.09	0.09	0.07	0.07	0.07	(5.2)	0.05	(7.2)
Small Signal Transistor	0.07	0.06	0.05	0.05	0.05	0.04	0.04	0.04	(6.5)	0.03	(5.6)
Power Transistor	0.49	0.41	0.39	0.39	0.38	0.36	0.36	0.34	(3.1)	0.31	(1.8)
Diode	0.06	0.06	0.05	0.05	0.04	0.04	0.05	0.05	(4.9)	0.04	(0.2)
Small Signal Diode	0.03	0.03	0.02	0.02	0.02	0.02	0.02	0.02	(6.5)	0.02	
Power Diode	0.09	0.11	0.09	0.09	0.08	0.08	0.08	0.08	(5.2)	0.07	(2.6)
Zener Diode	0.12	0.11	0.11	0.11	0.10	0.10	0.10	0.10	(1.6)	0.11	1.9
Thyristor	0.92	0.68	0.68	0.68	0.67	0.67	0.67	0.66	(0.5)	0.66	
Other Discrete	0.23	0.20	0.20	0.19	0.19	0.18	0.18	0.17	(2.7)	0.15	(2.5)
Total Optoelectronic	0.36	0.34	0.34	0.33	0.33	0.32	0.32	0.31	(1.3)	0.29	(1.9)
LED Lamps	0.12	0.11	0.11	0.10	0.10	0.09	0.09	0.09	(3.3)	0.08	(2.3)
LED Displays	1.37	1.35	1.34	1.30	1.30	1.29	1.29	1.28	(0.9)	1.24	(0.6)
Optical Couplers	0.66	0.62	0.62	0.62	0.62	0.61	0.61	0.61	(0.3)	0.59	(0.7)
Other Optoelectronics	1.07	1.01	1.01	1.00	1.00	0.99	0.99	0.99	(0.3)	0.98	(0.2)

Source: DATAQUEST

TABLE 15

HISTORICAL WORLDWIDE SEMICONDUCTOR CONSUMPTION
(Millions of Units)
1975 through 1984

	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	CAG % (75-84)
Total Semiconductor	14,872	20,694	24,900	30,839	37,272	43,573	46,849	45,962	57,655	79,963	20.8
Total Integrated Circuit	2,155	2,964	3,558	5,024	7,092	8,727	9,478	10,489	13,680	20,102	28.2
Bipolar Digital (Technology)	1,137	1,418	1,506	2,002	2,937	3,391	3,339	3,890	4,612	7,385	23.1
TTL											
DTL											
ECL											
Other Bipolar Digital											
Bipolar Digital (Function)	1,137	1,418	1,506	2,002	2,937	3,391	3,339	3,890	4,612	7,385	23.1
Bipolar Digital Memory											
Bipolar Digital Logic											
MOS (Technology)	304	518	769	1,221	1,734	2,599	2,896	3,297	4,651	6,603	40.8
NMOS	30	80	147	305	597	1,041	1,042	1,341	1,729	2,396	62.7
PMOS	152	157	204	299	276	287	265	221	206	213	3.8
CMOS	122	281	418	617	861	1,270	1,588	1,735	2,716	3,994	47.3
MOS (Function)	304	518	769	1,221	1,734	2,599	2,896	3,297	4,651	6,603	40.8
MOS Memory					329	451	644	874	1,136	1,643	
MOS Micro Devices					137	239	319	395	592	740	
MOS Logic					1,269	1,909	1,933	2,029	2,923	4,220	
Linear	714	1,027	1,283	1,801	2,422	2,737	3,243	3,301	4,417	6,115	26.9
Total Discrete	12,466	17,388	20,679	24,917	29,068	33,288	35,326	33,314	41,191	55,893	18.1
Transistor	4,810	6,940	7,513	9,113	10,060	11,750	13,826	13,464	16,176	24,456	19.8
Small Signal Transistor	4,193	6,192	6,867	8,109	8,910	10,422	12,178	11,913	14,314	21,617	20.0
Power Transistor	616	748	646	1,004	1,150	1,328	1,648	1,552	1,861	2,839	18.5
Diode	7,349	9,956	12,643	15,189	18,040	20,360	20,431	18,683	23,681	29,376	16.6
Small Signal Diode	4,140	5,620	7,775	9,250	10,925	11,950	11,350	9,825	13,900	17,967	17.7
Power Diode	2,627	3,543	4,021	5,100	5,733	7,145	7,710	7,388	8,322	9,627	14.7
Zener Diode	582	793	847	839	1,382	1,264	1,371	1,469	1,458	2,382	16.9
Thyristor	220	272	326	373	410	409	327	332	339	637	12.5
Other Discrete	87	140	197	243	558	769	742	835	996	1,425	36.4
Total Optoelectronic	250	422	671	898	1,111	1,557	2,045	2,159	2,784	3,968	36.0
LED Lamps					661	1,046	1,500	1,558	2,042	2,909	
LED Displays					167	185	190	220	243	310	
Optical Couplers					101	120	158	184	245	371	
Other Optoelectronics					182	206	196	196	254	378	

Source: DATAQUEST

TABLE 16

WORLDWIDE SEMICONDUCTOR CONSUMPTION FORECAST
(Millions of Units)
1983 through 1990, plus 1995

	1983	1984	1985	1986	1987	1988	1989	1990	CAG % (84-90)	1995	CAG % (90-95)
Total Semiconductor	57,655	79,963	89,759	96,364	113,427	136,056	135,765	149,404	11.0	313,674	16.0
Total Integrated Circuit	13,680	20,102	18,201	21,080	26,634	31,491	33,679	38,032	11.2	84,543	17.3
Bipolar Digital (Technology)	4,612	7,385	5,955	6,871	8,330	9,605	9,564	10,244	5.6	22,053	16.6
TTL											
DTL											
ECL											
Other Bipolar Digital											
Bipolar Digital (Function)	4,612	7,385	5,955	6,871	8,330	9,605	9,564	10,244	5.6	22,053	16.6
Bipolar Digital Memory											
Bipolar Digital Logic											
MOS (Technology)	4,651	6,603	6,153	7,474	10,020	12,374	13,945	17,165	17.3	43,550	20.5
NMOS	1,729	2,396	2,281	2,699	3,461	3,934	3,420	3,516	6.6	6,327	12.5
PMOS	206	213	145	115	115	107	64	60	(19.0)	58	(0.7)
CMOS	2,716	3,994	3,727	4,660	6,444	8,333	10,461	13,589	22.6	37,165	22.3
MOS (Function)	4,651	6,603	6,153	7,474	10,020	12,374	13,945	17,165	17.3	43,550	20.5
MOS Memory	1,136	1,643	1,800	2,263	3,183	4,112	4,604	5,308	21.6	15,252	23.5
MOS Micro Devices	592	740	804	1,122	1,710	2,406	2,951	4,198	33.6	11,561	22.5
MOS Logic	2,923	4,220	3,549	4,089	5,127	5,855	6,390	7,659	10.4	16,737	16.9
Linear	4,417	6,115	6,093	6,735	8,283	9,512	9,569	10,624	9.6	18,941	12.3
Total Discrete	41,191	55,893	67,689	70,815	81,660	96,310	96,321	103,954	10.9	207,948	14.9
Transistor	16,176	24,456	27,977	28,379	32,689	44,014	45,422	49,724	12.6	132,674	21.7
Small Signal Transistor	14,314	21,617	24,900	25,200	28,900	39,350	40,650	44,250	12.7	123,300	22.7
Power Transistor	1,861	2,839	3,077	3,179	3,789	4,664	4,772	5,474	11.6	9,574	11.8
Diode	23,681	29,376	37,751	40,200	46,300	51,185	47,828	50,673	9.5	69,286	6.5
Small Signal Diode	13,900	17,967	24,650	26,000	28,350	31,450	28,700	30,550	9.3	38,500	4.7
Power Diode	8,322	9,027	10,956	11,900	15,150	16,325	15,788	16,863	11.0	26,686	9.6
Zener Diode	1,458	2,382	2,145	2,300	2,800	3,410	3,340	3,260	5.4	4,100	4.7
Thyristor	339	637	566	604	685	767	682	670	0.8	802	3.7
Other Discrete	996	1,425	1,395	1,632	1,985	2,344	2,389	2,888	12.5	4,987	11.5
Total Optoelectronic	2,784	3,968	3,868	4,468	5,134	6,254	6,365	7,418	11.0	21,182	23.4
LED Lamps	2,642	2,989	2,818	3,290	3,720	4,576	4,589	5,411	10.9	15,788	23.9
LED Displays	243	310	312	344	399	454	450	502	8.4	1,240	19.8
Optical Couplers	245	371	368	411	498	597	651	748	12.4	2,090	22.8
Other Optoelectronics	254	378	370	423	516	625	676	757	12.2	2,065	22.2

Source: DATAQUEST

TABLE 17

HISTORICAL WORLDWIDE SEMICONDUCTOR FACTORY SHIPMENTS
(Millions of Dollars)
1975 through 1984

	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	CAG % (75-84)
Total Semiconductor	4,396	5,872	6,848	8,829	10,995	13,933	14,568	15,029	19,176	28,676	23.2
Total Integrated Circuit	2,162	2,977	3,643	5,106	6,909	9,361	9,786	10,662	14,368	22,353	29.6
Bipolar Digital (Technology)	682	865	994	1,261	1,674	2,374	2,337	2,412	2,998	4,800	24.2
TTL	499	682	771	990	1,365	1,930	1,823	1,889	2,423	4,055	26.2
DTL	81	71	61	55	51	45	43	40	40	38	(8.1)
ECL	55	76	95	138	170	300	376	391	445	607	30.6
Other Bipolar Digital	47	36	67	78	88	99	95	92	90	100	8.8
Bipolar Digital (Function)	682	865	994	1,261	1,674	2,374	2,337	2,412	2,998	4,800	24.2
Bipolar Digital Memory					324	572	558	511	593	831	
Bipolar Digital Logic					1,350	1,802	1,779	1,901	2,405	3,969	
MOS (Technology)	837	1,239	1,584	2,332	3,346	4,715	4,822	5,642	8,013	12,967	35.6
NMOS	133	377	655	1,361	2,184	3,207	3,190	3,902	5,445	8,818	59.4
PMOS	609	658	613	574	497	503	451	376	361	373	(5.3)
CMOS	95	204	316	397	665	1,005	1,181	1,364	2,207	3,776	50.6
MOS (Function)	837	1,239	1,584	2,332	3,346	4,715	4,822	5,642	8,013	12,967	35.6
MOS Memory					1,676	2,230	2,075	2,701	3,691	6,163	
MOS Micro Devices					541	862	1,085	1,318	2,013	3,217	
MOS Logic					1,129	1,623	1,662	1,623	2,309	3,587	
Linear	643	873	1,065	1,513	1,889	2,272	2,627	2,606	3,357	4,586	24.4
Total Discrete	2,019	2,612	2,983	3,301	3,522	3,883	3,985	3,547	3,796	4,973	10.5
Transistor	1,048	1,351	1,460	1,625	1,696	1,841	2,019	1,791	1,914	2,461	9.9
Small Signal Transistor	629	805	800	892	891	938	1,096	953	1,002	1,297	8.4
Power Transistor	419	546	660	733	805	903	923	838	912	1,164	12.0
Diode	700	896	1,001	1,184	1,277	1,441	1,417	1,249	1,341	1,794	11.0
Small Signal Diode	207	281	311	370	437	478	454	393	417	539	11.2
Power Diode	394	496	563	663	688	786	771	665	749	993	10.8
Zener Diode	99	119	127	151	152	177	192	191	175	262	11.4
Thyristor	183	242	300	339	365	401	356	315	312	433	10.0
Other Discrete	88	123	142	153	184	200	193	192	229	285	13.9
Total Optoelectronic	215	283	302	422	564	689	797	820	1,012	1,350	22.6
LED Lamps	31	53	73	101	119	136	180	187	245	320	29.8
LED Displays	123	148	139	187	234	268	265	286	333	418	14.6
Optical Couplers	21	29	34	52	88	100	122	129	162	230	30.5
Other Optoelectronics	40	53	56	82	131	185	210	218	272	382	28.5

Source: DATAQUEST

TABLE 18

HISTORICAL NORTH AMERICAN SEMICONDUCTOR FACTORY SHIPMENTS
(Millions of Dollars)
1975 through 1984

	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	CAG % (75-84)
Total Semiconductor	2,065	2,716	3,189	3,797	4,966	6,427	6,629	7,043	8,760	12,691	22.4
Total Integrated Circuit	1,249	1,670	2,022	2,572	3,557	4,792	4,983	5,425	7,108	10,527	26.7
Bipolar Digital (Technology)	395	505	597	741	958	1,439	1,371	1,369	1,736	2,948	25.0
TTL	303	410	498	633	833	1,261	1,203	1,192	1,551	2,598	27.0
DTL	43	41	34	32	27	21	15	13	15	12	(13.2)
ECL	33	39	35	55	65	108	108	119	130	298	27.7
Other Bipolar Digital	16	15	30	21	33	49	45	45	40	40	10.7
Bipolar Digital (Function)	395	505	597	741	958	1,439	1,371	1,369	1,736	2,948	25.0
Bipolar Digital Memory											
Bipolar Digital Logic											
MOS (Technology)	540	807	1,030	1,321	1,941	2,550	2,596	3,142	4,111	6,665	30.8
NMOS	108	304	493	811	1,294	1,783	1,710	2,177	2,888	4,386	50.9
PMOS	355	338	274	201	129	234	228	212	192	159	(8.5)
CMOS	77	165	263	309	518	613	658	753	1,111	1,520	39.3
MOS (Function)	540	807	1,030	1,321	1,941	2,550	2,596	3,142	4,111	6,665	30.8
MOS Memory											
MOS Micro Devices											
MOS Logic											
Linear	314	358	395	510	658	883	936	914	1,261	1,514	19.1
Total Discrete	677	892	1,042	1,059	1,176	1,374	1,430	1,306	1,291	1,667	10.5
Transistor	319	422	512	556	595	659	740	662	626	782	10.5
Small Signal Transistor	159	228	247	267	301	316	378	362	331	462	12.6
Power Transistor	160	194	265	289	294	343	362	300	295	320	8.0
Diode	234	303	341	329	400	497	501	498	507	675	12.5
Small Signal Diode	54	74	79	54	71	89	89	97	87	101	7.2
Power Diode	131	166	200	198	240	305	296	260	318	413	13.6
Zener Diode	49	63	62	77	89	103	116	141	102	161	14.1
Thyristor	72	104	127	129	130	149	148	102	100	169	9.9
Other Discrete	52	63	62	45	51	69	41	44	58	41	(2.6)
Total Optoelectronic	139	154	125	166	233	261	296	312	361	497	15.2
LED Lamps	14	18	29	37	28	26	37	40	49	70	19.6
LED Displays	91	97	65	72	96	90	96	75	75	94	0.4
Optical Couplers	13	19	20	30	44	57	64	75	89	128	28.9
Other Optoelectronics	21	20	11	27	65	88	99	122	148	205	28.8

Source: DATAQUEST

TABLE 19

HISTORICAL JAPANESE SEMICONDUCTOR FACTORY SHIPMENTS
(Millions of Dollars)
1975 through 1984

	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	CAG % (75-84)
Total Semiconductor	1,008	1,526	1,708	2,525	2,892	3,768	4,707	4,681	6,668	10,647	29.9
Total Integrated Circuit	411	652	765	1,337	1,722	2,448	3,058	3,308	4,832	8,136	39.3
Bipolar Digital (Technology)	82	115	132	193	233	317	425	516	650	1,065	33.0
TTL											
DTL											
ECL											
Other Bipolar Digital											
Bipolar Digital (Function)	82	115	132	193	233	317	425	516	650	1,065	33.0
Bipolar Digital Memory											
Bipolar Digital Logic											
MOS (Technology)	184	274	307	625	875	1,314	1,519	1,730	2,805	5,105	44.7
NMOS	19	57	109	389	596	933	1,040	1,242	1,931	3,191	76.7
PMOS	152	189	167	183	192	114	100	81	85	127	(2.0)
CMOS	13	28	31	53	87	267	379	407	789	1,787	72.8
MOS (Function)	184	274	307	625	875	1,314	1,519	1,730	2,805	5,105	44.7
MOS Memory											
MOS Micro Devices											
MOS Logic											
Linear	145	263	326	519	614	817	1,114	1,062	1,377	1,966	33.6
Total Discrete	572	829	875	1,083	1,025	1,118	1,372	1,183	1,432	1,952	14.6
Transistor	339	488	474	544	494	529	676	524	707	940	12.0
Small Signal Transistor	210	311	278	331	266	277	374	261	346	451	8.9
Power Transistor	129	177	196	213	228	252	302	263	361	489	16.0
Diode	177	259	298	397	376	421	511	402	507	691	16.3
Small Signal Diode	62	82	91	126	131	150	206	164	208	284	18.4
Power Diode	95	152	178	234	212	235	264	204	256	349	15.6
Zener Diode	20	25	29	43	33	36	41	34	43	58	12.6
Thyristor	33	47	61	78	88	95	91	80	95	131	16.6
Other Discrete	23	35	42	64	67	73	94	97	123	190	26.4
Total Optoelectronic	25	45	68	105	145	202	277	270	404	559	41.2
LED Lamps	3	6	6	13	43	68	92	90	132	181	57.7
LED Displays	12	20	32	55	59	78	105	109	165	227	38.6
Optical Couplers	3	4	3	8	10	13	23	23	35	49	36.4
Other Optoelectronics	7	15	27	29	33	43	57	48	72	102	34.7

Source: DATAQUEST

TABLE 20

HISTORICAL JAPANESE SEMICONDUCTOR FACTORY SHIPMENTS
(Billions of Yen)
1975 through 1984

	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	CAG % (75-84)
Total Semiconductor	299.4	451.7	459.5	530.3	633.3	855.3	1,040.2	1,160.9	1,567.0	2,523.3	26.7
Total Integrated Circuit	122.1	193.0	205.8	280.8	377.1	565.7	675.8	820.4	1,135.5	1,928.2	35.9
Bipolar Digital (Technology)	24.4	34.0	35.5	40.5	51.0	72.0	93.9	128.0	152.8	252.4	29.7
TTL											
DTL											
ECL											
Other Bipolar Digital											
Bipolar Digital (Function)	24.4	34.0	35.5	40.5	51.0	72.0	93.9	128.0	152.8	252.4	29.7
Bipolar Digital Memory											
Bipolar Digital Logic											
MOS (Technology)	54.6	81.1	82.6	131.3	191.6	298.3	335.7	429.0	659.2	1,209.9	41.1
NMOS	5.6	16.9	29.3	81.7	130.5	211.8	229.8	308.0	453.8	756.3	72.3
PMOS	45.1	55.9	44.9	38.4	42.0	25.9	22.1	20.1	20.0	30.1	(4.4)
CMOS	3.9	8.3	8.3	11.1	19.1	60.6	83.8	100.9	185.4	423.5	68.5
MOS (Function)	54.6	81.1	82.6	131.3	191.6	298.3	335.7	429.0	659.2	1,209.9	41.1
MOS Memory											
MOS Microprocessor											
MOS Logic											
Linear	43.1	77.8	87.7	109.0	134.5	185.5	246.2	263.4	323.6	465.9	30.3
Total Discrete	169.9	245.4	235.4	227.4	224.5	253.8	383.2	273.5	336.5	462.8	11.8
Transistor	100.7	144.4	127.5	114.2	108.2	120.1	149.4	130.0	166.1	222.8	9.2
Small Signal Transistor	62.4	92.1	74.8	69.5	58.3	62.9	82.7	64.7	81.3	106.9	6.2
Power Transistor	38.3	52.4	52.7	44.7	49.9	57.2	66.7	65.2	84.8	115.9	13.1
Diode	52.6	76.7	80.2	83.4	82.3	95.6	112.9	99.7	119.1	163.8	13.5
Small Signal Diode	18.4	24.3	24.5	25.2	28.7	34.0	45.5	40.7	48.9	67.3	15.5
Power Diode	28.2	45.0	47.9	49.1	46.4	53.3	58.3	50.6	60.2	82.7	12.7
Zener Diode	5.9	7.4	7.8	9.0	7.2	8.2	9.1	8.4	10.1	13.7	9.8
Thyristor	9.8	13.9	16.4	16.4	19.3	21.6	20.1	19.8	22.3	31.0	13.7
Other Discrete	6.8	10.4	11.3	13.4	14.7	16.6	20.8	24.1	28.9	45.0	23.3
Total Optoelectronic	7.4	13.3	18.3	22.0	31.8	45.9	61.2	67.0	94.9	132.5	37.7
LED Lamps	0.9	1.8	1.6	2.7	9.4	15.4	20.3	22.3	31.0	42.9	53.8
LED Displays	3.6	5.9	8.6	11.6	12.9	17.7	23.2	27.0	38.8	53.8	35.2
Optical Couplers	0.9	1.2	0.8	1.7	2.2	3.0	5.1	5.7	6.2	11.6	33.0
Other Optoelectronics	2.1	4.4	7.3	6.1	7.2	9.8	12.6	11.9	16.9	24.2	31.3
Exchange Rate (Yen/US$)	297.0	296.0	269.0	210.0	219.0	227.0	221.0	248.0	235.0	237.0	

Source: DATAQUEST

TABLE 21

HISTORICAL WESTERN EUROPEAN SEMICONDUCTOR FACTORY SHIPMENTS
(Millions of Dollars)
1975 through 1984

	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	CAG % (75-84)
Total Semiconductor	1,203	1,443	1,747	2,215	2,706	3,181	2,706	2,726	3,033	4,355	15.4
Total Integrated Circuit	451	559	750	1,064	1,431	1,867	1,566	1,608	2,012	3,096	23.9
Bipolar Digital (Technology)	175	187	206	259	386	500	435	404	460	668	14.8
TTL											
DTL											
ECL											
Other Bipolar Digital											
Bipolar Digital (Function)	175	187	206	259	386	500	435	404	460	668	14.8
Bipolar Digital Memory											
Bipolar Digital Logic											
MOS (Technology)	108	152	238	364	481	780	629	660	964	1,583	34.8
NMOS	6	16	53	153	279	550	418	460	665	1,164	79.6
PMOS	97	125	163	179	157	140	114	78	82	85	(1.5)
CMOS	5	11	22	32	45	90	97	122	217	334	59.5
MOS (Function)	108	152	238	364	481	780	629	660	964	1,583	34.8
MOS Memory											
MOS Micro Devices											
MOS Logic											
Linear	168	220	306	441	564	587	502	544	588	905	20.6
Total Discrete	717	823	908	1,023	1,137	1,157	984	943	845	1,064	4.5
Transistor	350	385	415	421	463	472	448	455	385	498	4.0
Small Signal Transistor	220	215	222	197	208	208	237	233	195	252	1.5
Power Transistor	130	170	193	224	255	264	211	222	190	246	7.3
Diode	276	322	348	433	471	481	371	312	300	388	3.9
Small Signal Diode	78	113	127	176	215	213	139	107	105	136	6.4
Power Diode	168	178	185	229	230	236	202	194	171	221	3.1
Zener Diode	30	31	36	28	26	32	30	11	24	31	0.4
Thyristor	78	91	111	129	142	151	111	128	114	128	5.7
Other Discrete	13	25	34	40	61	53	54	48	46	50	16.1
Total Optoelectronic	35	61	89	128	138	157	156	175	176	195	21.0
LED Lamps	10	23	35	47	41	32	39	43	49	49	19.3
LED Displays	13	20	31	44	53	54	46	66	56	57	17.8
Optical Couplers	3	4	9	13	17	25	27	28	34	44	34.8
Other Optoelectronics	9	14	14	24	27	46	44	38	37	45	19.6

Source: DATAQUEST

TABLE 22

HISTORICAL REST OF WORLD SEMICONDUCTOR FACTORY SHIPMENTS
(Millions of Dollars)
1975 through 1984

	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	CAG % (75-84)
Total Semiconductor	120	187	204	292	431	557	526	579	715	983	26.3
Total Integrated Circuit	51	96	106	133	199	254	259	321	416	594	31.4
Bipolar Digital (Technology)	30	58	59	68	97	118	106	123	152	179	22.0
TTL											
DTL											
ECL											
Other Bipolar Digital											
Bipolar Digital (Function)	30	58	59	68	97	118	106	123	152	179	22.0
Bipolar Digital Memory											
Bipolar Digital Logic											
MOS (Technology)	5	6	9	22	49	71	78	110	133	214	51.8
NMOS				8	15	21	22	23	41	77	
PMOS	5	6	9	11	19	15	9	5	2	2	(9.7)
CMOS				3	15	35	47	82	90	135	
MOS (Function)	5	6	9	22	49	71	78	110	133	214	51.8
MOS Memory											
MOS Micro Devices											
MOS Logic											
Linear	16	32	38	43	53	65	75	88	131	201	32.5
Total Discrete	53	68	78	136	184	234	199	195	228	290	20.8
Transistor	40	56	59	104	144	181	155	150	196	241	22.1
Small Signal Transistor	40	51	53	97	116	137	107	97	130	132	14.2
Power Transistor		5	6	7	28	44	48	53	66	109	
Diode	13	12	14	25	30	42	34	37	27	40	13.3
Small Signal Diode	13	12	14	20	20	26	20	25	17	18	3.7
Power Diode				2	6	10	9	7	4	10	
Zener Diode				3	4	6	5	5	6	12	
Thyristor			1	3	5	6	6	5	3	5	
Other Discrete			4	4	5	5	4	3	2	4	
Total Optoelectronic	16	23	20	23	48	69	68	63	71	99	22.4
LED Lamps	4	6	3	4	7	10	12	14	15	20	19.6
LED Displays	7	11	11	16	26	46	38	36	37	40	21.4
Optical Couplers	2	2	2	1	9	5	8	3	4	9	18.2
Other Optoelectronics	3	4	4	2	6	8	10	10	15	30	29.2

Source: DATAQUEST

Consumption and Factory Shipments

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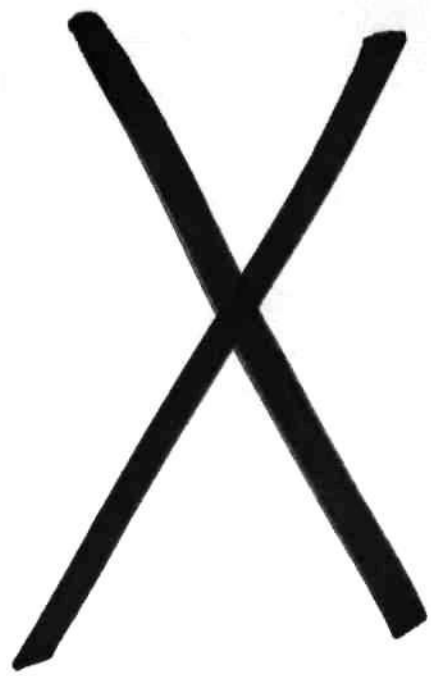

Consumption and Shipment Data

The following is a list of the material in this section:

- Consumption and Factory Shipments

Consumption and Factory Shipments

INTRODUCTION

Consumption/factory shipments data comprise a set of detailed tables that estimate semiconductor consumption and semiconductor factory shipments both worldwide and for four major geographical regions for the years 1976 through 1991 and 1996. Semiconductor consumption tables are divided into historical data tables and forecast tables. Semiconductor factory shipments tables are historical data tables only. All historical tables begin with 1976 and end with 1985, while all forecast tables provide annual market size estimates for 1984 through 1991, with additional estimates for 1996. Please refer to the "Forecast" section for a discussion of the differences between historical and future dollar values. A list of tables detailing the type of data, region, years and units, is as follows:

LIST OF TABLES--CONSUMPTION/FACTORY SHIPMENTS

Table	Region Covered	Years	Units
0	Japan, Western Europe Exchange Rates	1970-1985	Various
1a	Worldwide Consumption	1977-1982	Dollars
1b	Worldwide Consumption	1983-1988	Dollars
1c	Worldwide Consumption	1989-1991; 1996	Dollars
2a	North American Consumption	1977-1982	Dollars
2b	North American Consumption	1983-1988	Dollars
2c	North American Consumption	1989-1991; 1996	Dollars
3a	Japan Consumption	1977-1982	Dollars
3b	Japan Consumption	1983-1988	Dollars
3c	Japan Consumption	1989-1991; 1996	Dollars
4a	Japan Consumption	1977-1982	Yen
4b	Japan Consumption	1983-1988	Yen
4c	Japan Consumption	1989-1991; 1996	Yen
5a	Western Europe Consumption	1977-1982	Dollars
5b	Western Europe Consumption	1983-1988	Dollars
5c	Western Europe Consumption	1989-1991; 1996	Dollars
6a	Rest of World Consumption	1977-1982	Dollars
6b	Rest of World Consumption	1983-1988	Dollars
6c	Rest of World Consumption	1989-1991; 1996	Dollars
7a	Worldwide Average Selling Prices	1977-1982	Dollars
7b	Worldwide Average Selling Prices	1983-1988	Dollars
7c	Worldwide Average Selling Prices	1989-1991; 1996	Dollars

(Continued)

Consumption and Factory Shipments

LIST OF TABLES--CONSUMPTION/FACTORY SHIPMENTS (Continued)

Each table gives estimates of semiconductor consumption or factory shipments listed by the major semiconductor device product categories. In these tables, semiconductor components are divided into three major product groups: integrated circuits, discrete devices, and optoelectronic devices. These groups are divided into a number of subgroups, some of which are segmented further.

DEFINITIONS AND CONVENTIONS

Dataquest uses a common manufacturer base for all data tables. This base includes all suppliers to the merchant semiconductor market. It excludes captive suppliers that manufacture devices solely for the benefit of the parent company, such as AT&T Technologies (formerly Western Electric), Burroughs, and IBM. Included, however, are companies that actively market semiconductor devices to the merchant market as well as to other divisions of their own companies. A recent case in point is NCR, previously a captive supplier, which in 1982 offered products on the merchant market for the first time. For such companies, both external shipments and internal consumption are included. Devices that are used internally are valued at current market prices.

Consumption--Dataquest defines consumption as the purchase of a semiconductor device or devices. This definition must be differentiated from actual use of the device in a final product. Devices that are inventoried at the user level are considered consumption according to our definition.

Consumption and Factory Shipments

Factory Shipments Location--The fabrication and assembly of a semiconductor device may be performed in several different locations. Factory shipment is defined as occurring from that point where the device was tested and marked, irrespective of where the device was assembled or where the initial wafer fabrication was performed.

Hybrids--In earlier consumption/factory shipment data, hybrid devices were included as a separate segment of integrated circuits. However, since hybrid devices are primarily a special packaging arrangement, this segment has been omitted. Hybrid devices manufactured by semiconductor companies are now included in the most appropriate product segment, usually the linear segment.

Power Devices--The difference between low-power and high-power transistors is set at the 1-watt power-handling capability. Power diodes are rated at 1 amp or higher; small-signal diodes are rated at less than 1 amp. Special discrete devices that are neither transistors, diodes, nor thyristors are categorized as "other discretes."

The manufacturer base product group definitions and guidelines for including value of output that we have used in our tables may differ from those used in other studies of this type. Our base is nearly the same as that used by the World Semiconductor Trade Statistics program (WSTS).

Regions--North America is defined as including both the United States and Canada. Latin America, including Mexico, is considered part of the Rest of World (ROW) category. Western Europe includes Austria, Belgium, the Federal Republic of Germany, France, Greece, Italy, Luxembourg, the Scandinavian countries (Denmark, Finland, Norway, Sweden), Spain, and the United Kingdom.

DATA SOURCES

The information presented in the consumption/factory shipment data has been consolidated from a variety of sources, each of which focuses on a specific part of the market. These sources include the following:

- U.S. Commerce Department trade statistics, World Semiconductor Trade Statistics (WSTS) data, and Dataquest's estimates of regional company sales are used to determine North American consumption and factory shipments.

Consumption and Factory Shipments

- Japanese trade statistics compiled and published by the Ministry of Finance (MOF), and the Ministry of International Trade and Industry (MITI), WSTS data, and Dataquest's estimates of regional company sales are used to determine Japanese factory shipments and consumption.

- For West European markets, U.S. Department of Commerce trade statistics, marketing statistics from WSTS data, and Dataquest's estimates of regional company sales are used to determine factory shipments and consumption.

- In ROW, the major published sources used to estimate consumption and factory shipments are U.S. Department of Commerce and MITI trade statistics, WSTS data, and Dataquest's estimates of company shipments into the region.

Dataquest believes that the estimates presented here are the most accurate and meaningful generally available today. The sources of the data and the guidelines for the forecasts presented in the tables are:

- Unit sales or revenue (or both) published by major industry participants, both in the United States and abroad

- Estimates presented by knowledgeable and reliable industry spokesmen

- Government data or trade association data such as those from the Electronics Industry Association (EIA), MITI, WSTS, and the U.S. Department of Commerce

- Published product literature and price lists

- Interviews with knowledgeable manufacturers, distributors, and users

- Relevant projected world economic data

CONSISTENCY

One of the key objectives in preparing these estimates is to achieve consistency among the various data elements that constitute the forecast and the historical data base. To ensure the accuracy and consistency of the estimates, we have compared the value of directly obtained data elements with values obtained by indirect means, wherever possible. Thus, the worldwide totals in the consumption/factory shipment analysis are consistent with the worldwide totals of the market share analysis. However, the regional factory shipment totals of the market share data do

not and should not equal the regional factory shipments totals of the consumption/factory shipment tables because this latter analysis includes factories of all national origins producing in a given region. For example, factory shipments in Japan includes companies like Texas Instruments Japan.

ACCURACY

The tables presented here represent Dataquest estimates that we believe are reasonably accurate. Where we have no reasonable estimate, none is given. A blank space in a table indicates that a reasonably accurate estimate is unavailable, and a zero in a table represents an estimate.

VALUATION OF CONSUMPTION AND FACTORY SHIPMENTS

Regional consumption and factory shipments are all expressed in U.S. dollars, (Japanese consumption and shipments are, however, also expressed in yen). To make the tables in this study useful in comparing different regions, it is necessary to express all values in a common currency and, because of the U.S. producers' large presence in international markets, the dollar is the preferred choice.

However, the choice of the U.S. dollar (or any single currency, for that matter) as the currency basis for the tables, brings with it some problems that require the readers' careful consideration in interpreting the data.

Inflation

All countries that participate significantly in international semiconductor markets suffered from an overall price inflation in the 1970s, continuing into the 1980s.

As a consequence, the dollar in a given year is not truly comparable with the dollar in any preceding year. Consumer and wholesale price indices and GNP deflators all measure price changes in various composite "market baskets" of goods. However, there is no price index that measures price changes of material, equipment, and labor inputs to the semiconductor industry. Indeed, the "mix" is changing so rapidly that what is used this year was sometimes unavailable last year, at any price. Nor is there a composite price index that measures price changes in aggregate semiconductor product. In an industry noted for its

deflationary trends, this latter effect would tend to make the component purchaser's dollar worth more as time passed, in terms of electronic purchasing ability.

We have made no adjustments in the historical data to account for these inflationary and deflationary effects. The data are expressed in current dollars (dollars that include the inflation rate and exchange rates of the given year) for all historical data; comparisons between different years must be interpreted accordingly.

Average Selling Prices

When considering the worldwide average selling prices (ASPs) for semiconductor components, one must look at the price per function of a circuit, the complexity of the circuit, and the product mix according to this increasing complexity. It is true that one characteristic of the semiconductor industry is that the price per function for integrated circuits has been dropping an average of 30 percent per year for the last 15 years. At the same time, circuits have become denser, resulting in an overall increase in the price of a device with a decreasing cost per function. Thus, Table 14 shows the worldwide ASPs increasing after many years of decreasing, due to the move toward higher-complexity devices. There are also regional differences in ASPs due to regional competition differences and the varying regional product consumption mix. The worldwide ASP is truly an aggregate measure and may differ significantly from ASPs in any specific market at any point in time.

Exchange Rates

Construction of the West European tables involves combining data from many countries, each of which has different and changing exchange rates. Dataquest uses Annual Foreign Exchange Rates for each year as published by The International Monetary Fund. As far as possible, we prepare our estimates in terms of local currencies before conversion to U.S. dollars. The exchange rates for major currencies can be found in Table 0 at the end of this introduction.

Japanese consumption and factory shipments are based on MITI data, which are originally expressed in yen. The Japanese data published in this study are expressed in both dollars (Tables 5, 6, and 19) and in yen (Tables 7, 8, and 20). The yen/dollar exchange rate used for each year can be found in Table 0. Because of the fluctuations in the exchange rate for the yen, the dollar values given tend to distort the growth rate of the Japanese market, but they do provide a useful basis for regional market size comparisons. However, the data in yen give a better picture of the real growth in the Japanese market.

Consumption and Factory Shipments

FORECAST

As mentioned previously, historical data are expressed in current dollars or dollars that include the given year's inflation rate and exchange rates. However, the consumption forecasts, which appear in Tables 2, 4, 6, 8, 10, and 12, use constant dollars and exchange rates, with no allowance for inflation or variations in the rates of exchange between countries. All estimates for 1986 and beyond are made as if 1986 monetary conditions will continue through 1996 and, therefore, show the absolute year-to-year growth during this period.

Information on interregional trade and other analyses used in the preparation of these tables is available to Dataquest clients upon request.

Table 0

ANNUAL FOREIGN EXCHANGE RATES
(Expressed in U.S. Dollars)

Year	Japan (Dollars per Yen)	France (Dollars per French Franc)	West Germany (Dollars per Deutsche Mark)	United Kingdom (Dollars per Pound Sterling)
1970	$0.002795	$0.1808	$0.2740	$2.3810
1971	$0.002913	$0.1815	$0.2874	$2.4390
1972	$0.003311	$0.1984	$0.3135	$2.5000
1973	$0.003721	$0.2247	$0.3745	$2.4390
1974	$0.003427	$0.2079	$0.3861	$2.3256
1975	$0.003368	$0.2331	$0.4065	$2.2222
1976	$0.003376	$0.2092	$0.3968	$1.8182
1977	$0.003761	$0.2037	$0.4310	$1.7544
1978	$0.004857	$0.2217	$0.4975	$1.9231
1979	$0.004518	$0.2353	$0.5464	$2.1277
1980	$0.004449	$0.2364	$0.5495	$2.3256
1981	$0.004519	$0.1842	$0.4425	$1.0408
1982	$0.004022	$0.1522	$0.4115	$1.7544
1983	$0.004203	$0.1312	$0.3922	$1.4085
1984	$0.004219	$0.1144	$0.3509	$1.3333
1985	$0.004202	$0.1114	$0.3401	$1.2821

Source: The International Monetary Fund
Dataquest
May 1986

Consumption and Factory Shipments

Table 1a

WORLDWIDE SEMICONDUCTOR CONSUMPTION
(Millions of Dollars)

	1977	1978	1979	1980	1981	1982
Total Semiconductor	6968	8953	11114	14118	14828	15261
Total IC	3763	5230	7028	9546	10046	10894
Bipolar Digital (Technology)	994	1261	1674	2374	2337	2412
TTL	771	990	1365	1930	1823	1889
ECL	95	138	170	300	376	391
Other Bipolar Digital	128	133	139	144	138	132
Bipolar Digital (Function)	994	1261	1674	2374	2337	2412
Bipolar Digital Memory			324	572	558	511
Bipolar Digital Logic			1350	1802	1779	1901
MOS (Technology)	1584	2332	3346	4715	4822	5642
NMOS	655	1361	2184	3207	3190	3902
PMOS	613	574	497	503	451	376
CMOS	316	397	665	1005	1181	1364
MOS (Function)	1584	2332	3346	4715	4822	5642
MOS Memory			1676	2230	2075	2701
MOS Micro Device			541	862	1085	1318
MOS Logic			1129	1623	1662	1623
Linear	1185	1637	2008	2457	2887	2840
Total Discrete	2903	3301	3522	3883	3985	3547
Total Optoelectronic	302	422	564	689	797	820

Source: Dataquest
October 1986
Ref. 1086

Consumption and Factory Shipments

Table 1b

WORLDWIDE SEMICONDUCTOR CONSUMPTION
(Millions of Dollars)

	1983	1984	1985	1986	1987	1988
Total Semiconductor	19665	29087	24823	30642	36080	45557
Total IC	14684	22753	18988	23508	28472	37024
Bipolar Digital (Technology)	2998	4812	3799	4486	5176	6384
TTL	2423	4067	3058			
ECL	445	607	607			
Other Bipolar Digital	130	138	134			
Bipolar Digital (Function)	2998	4812	3799	4486	5176	6384
Bipolar Digital Memory	593	719	603	685	761	894
Bipolar Digital Logic	2405	4093	3196	3801	4415	5490
MOS (Technology)	8013	13014	10422	12890	16593	22835
NMOS	5496	8850	6488	7231	8192	9732
PMOS	319	281	146	116	105	87
CMOS	2198	3883	3788	5543	8297	13016
MOS (Function)	8013	13014	10422	12890	16593	22835
MOS Memory	3691	6261	4013	4353	5607	8452
MOS Micro Device	2013	3261	2751	3485	4404	5841
MOS Logic	2309	3492	3658	5052	6582	8542
Linear	3673	4927	4767	6132	6703	7805
Total Discrete	3949	5054	4670	5557	5880	6482
Total Optoelectronic	1032	1280	1165	1577	1728	2051

Source: Dataquest
October 1986
Ref. 1086

Consumption and Factory Shipments

Table 1c

WORLDWIDE SEMICONDUCTOR CONSUMPTION
(Millions of Dollars)

	1989	1990	1991	CAGR (86-91)	1996	CAGR (91-96)
Total Semiconductor	45059	51832	62674	15.4%	133189	16.3%
Total IC	36514	42516	52204	17.3%	116897	17.5%
Bipolar Digital (Technology)	6059	6687	7904	12.0%	14812	13.4%
TTL						
ECL						
Other Bipolar Digital						
Bipolar Digital (Function)	6059	6687	7904	12.0%	14812	13.4%
Bipolar Digital Memory	888	934	1035	8.6%	1417	6.5%
Bipolar Digital Logic	5170	5753	6869	12.6%	13395	14.3%
MOS (Technology)	22778	27540	34894	22.0%	86588	19.9%
NMOS	7900	8195	7616	1.0%	6006	-4.6%
PMOS	72	67	61	-12.1%	55	-2.0%
CMOS	14806	19278	27217	37.5%	80527	24.2%
MOS (Function)	22778	27540	34894	22.0%	86588	19.9%
MOS Memory	7664	9356	11486	21.4%	26537	18.2%
MOS Micro Device	6365	7658	10207	24.0%	24905	19.5%
MOS Logic	8749	10526	13201	21.2%	35146	21.6%
Linear	7677	8289	9406	8.9%	15497	10.5%
Total Discrete	6531	7056	7820	7.1%	11319	7.7%
Total Optoelectronic	2014	2260	2650	10.9%	4973	13.4%

Source: Dataquest
October 1986
Ref. 1086

Consumption and Factory Shipments

Table 2a

NORTH AMERICAN SEMICONDUCTOR CONSUMPTION
(Millions of Dollars)

	1977	1978	1979	1980	1981	1982
Total Semiconductor	2876	3506	4538	6053	6529	6970
Total IC	1811	2335	3179	4562	4867	5466
Bipolar Digital (Technology)	537	666	901	1411	1339	1367
TTL						
ECL						
Other Bipolar Digital						
Bipolar Digital (Function)	537	666	901	1411	1339	1367
Bipolar Digital Memory			185	396	375	320
Bipolar Digital Logic			716	1015	964	1047
MOS (Technology)	830	1099	1703	2442	2595	3183
NMOS						
PMOS						
CMOS						
MOS (Function)	830	1099	1703	2442	2595	3183
MOS Memory			1028	1230	1107	1592
MOS Micro Device			186	377	489	641
MOS Logic			489	835	999	950
Linear	444	570	575	709	933	916
Total Discrete	940	1005	1161	1289	1398	1221
Total Optoelectronic	125	166	198	202	264	283

Source: Dataquest
October 1986
Ref. 1086

Table 2b

NORTH AMERICAN SEMICONDUCTOR CONSUMPTION
(Millions of Dollars)

	1983	1984	1985	1986	1987	1988
Total Semiconductor	9141	13139	9607	10219	11445	14893
Total IC	7400	10940	7710	8214	9415	12560
Bipolar Digital (Technology)	1729	2843	2006	2142	2302	2919
TTL						
ECL						
Other Bipolar Digital						
Bipolar Digital (Function)	1729	2843	2006	2142	2302	2919
Bipolar Digital Memory	423	431	315	339	371	446
Bipolar Digital Logic	1306	2412	1691	1803	1931	2473
MOS (Technology)	4416	6355	4247	4438	5378	7446
NMOS						
PMOS						
CMOS						
MOS (Function)	4416	6355	4247	4438	5378	7446
MOS Memory	2051	3248	1774	1659	2126	3110
MOS Micro Device	1068	1719	1195	1168	1367	1854
MOS Logic	1297	1388	1278	1611	1885	2482
Linear	1255	1742	1457	1634	1735	2195
Total Discrete	1397	1727	1528	1599	1611	1793
Total Optoelectronic	344	472	369	406	419	540

Source: Dataquest
October 1986
Ref. 1086

Table 2c

NORTH AMERICAN SEMICONDUCTOR CONSUMPTION
(Millions of Dollars)

	1989	1990	1991	CAGR (86-91)	1996	CAGR (91-96)
Total Semiconductor	14096	15615	18329	12.4%	37601	15.5%
Total IC	11838	13235	15735	13.9%	33720	16.5%
Bipolar Digital (Technology)	2718	2965	3442	10.0%	6220	12.6%
TTL						
ECL						
Other Bipolar Digital						
Bipolar Digital (Function)	2718	2965	3442	10.0%	6220	12.6%
Bipolar Digital Memory	447	468	517	8.8%	770	8.3%
Bipolar Digital Logic	2270	2497	2925	10.2%	5450	13.3%
MOS (Technology)	7013	7995	9700	16.9%	23100	19.0%
NMOS						
PMOS						
CMOS						
MOS (Function)	7013	7995	9700	16.9%	23100	19.0%
MOS Memory	2706	3100	3725	17.6%	7600	15.3%
MOS Micro Device	1937	2198	2650	17.8%	6500	19.7%
MOS Logic	2370	2697	3325	15.6%	9000	22.0%
Linear	2107	2275	2593	9.7%	4400	11.2%
Total Discrete	1757	1856	2008	4.7%	2976	8.2%
Total Optoelectronic	501	524	586	7.6%	905	9.1%

Source: Dataquest
October 1986
Ref. 1086

Consumption and Factory Shipments

Table 3a

JAPANESE SEMICONDUCTOR CONSUMPTION
(Millions of Dollars)

	1977	1978	1979	1980	1981	1982
Total Semiconductor	1723	2448	2768	3383	4295	4082
Total IC	864	1399	1738	2201	2793	2855
Bipolar Digital (Technology)	190	259	304	345	438	498
TTL						
ECL						
Other Bipolar Digital						
Bipolar Digital (Function)	190	259	304	345	438	498
Bipolar Digital Memory			52	57	77	87
Bipolar Digital Logic			252	288	361	411
MOS (Technology)	314	588	762	991	1174	1263
NMOS						
PMOS						
CMOS						
MOS (Function)	314	588	762	991	1174	1263
MOS Memory			256	423	491	534
MOS Micro Device			213	269	404	446
MOS Logic			293	299	279	283
Linear	360	552	672	865	1181	1094
Total Discrete	792	946	889	986	1237	970
Total Optoelectronic	67	103	141	196	265	257

Source: Dataquest
October 1986
Ref. 1086

Table 3b

JAPANESE SEMICONDUCTOR CONSUMPTION
(Millions of Dollars)

	1983	1984	1985	1986	1987	1988
Total Semiconductor	5651	8845	8599	12087	14426	17341
Total IC	4002	6705	6567	9320	11528	14133
Bipolar Digital (Technology)	624	999	953	1350	1686	1974
TTL						
ECL						
Other Bipolar Digital						
Bipolar Digital (Function)	624	999	953	1350	1686	1974
Bipolar Digital Memory	59	132	125	162	196	216
Bipolar Digital Logic	565	867	828	1188	1490	1758
MOS (Technology)	1920	3742	3595	5076	6767	8835
NMOS						
PMOS						
CMOS						
MOS (Function)	1920	3742	3595	5076	6767	8835
MOS Memory	865	1705	1353	1650	2137	3024
MOS Micro Device	594	913	936	1456	1908	2435
MOS Logic	461	1124	1306	1970	2722	3376
Linear	1458	1964	2019	2894	3075	3324
Total Discrete	1267	1669	1566	2031	2088	2276
Total Optoelectronic	382	471	466	736	810	932

Source: Dataquest
October 1986
Ref. 1086

Table 3c

JAPANESE SEMICONDUCTOR CONSUMPTION
(Millions of Dollars)

	1989	1990	1991	CAGR (86-91)	1996	CAGR (91-96)
Total Semiconductor	17484	20769	25018	19.5%	52436	16.0%
Total IC	14311	17165	20880	21.3%	45689	17.0%
Bipolar Digital (Technology)	1900	2166	2570	18.0%	4625	12.5%
TTL						
ECL						
Other Bipolar Digital						
Bipolar Digital (Function)	1900	2166	2570	18.0%	4625	12.5%
Bipolar Digital Memory	212	225	241	11.6%	315	5.5%
Bipolar Digital Logic	1688	1941	2329	18.8%	4310	13.1%
MOS (Technology)	9125	11404	14323	25.9%	34958	19.5%
NMOS						
PMOS						
CMOS						
MOS (Function)	9125	11404	14323	25.9%	34958	19.5%
MOS Memory	2752	3578	4222	20.9%	10506	20.0%
MOS Micro Device	2727	3305	4495	29.9%	10327	18.1%
MOS Logic	3646	4521	5606	27.5%	14125	20.3%
Linear	3286	3595	3987	12.0%	6106	8.9%
Total Discrete	2251	2523	2853	10.5%	4174	7.9%
Total Optoelectronic	922	1081	1285	18.4%	2573	14.9%

Source: Dataquest
October 1986
Ref. 1086

Consumption and Factory Shipments

Table 4a

JAPANESE SEMICONDUCTOR CONSUMPTION
(Billions of Yen)

	1977	1978	1979	1980	1981	1982
Total Semiconductor	463.5	514.1	606.2	768.1	949.1	1012.3
Total IC	232.4	293.8	380.7	499.7	617.3	708.0
Bipolar Digital (Technology)	51.1	54.4	66.6	78.3	96.8	123.5
TTL	19.4	20.8	28.5	33.6	41.5	53.3
ECL	15.3	16.4	25.6	30.2	37.3	45.6
Other Bipolar Digital	16.4	17.2	12.5	14.5	18.0	24.6
Bipolar Digital (Function)	51.1	54.4	66.6	78.3	96.8	123.5
Bipolar Digital Memory			11.4	12.9	17.0	21.6
Bipolar Digital Logic			55.2	65.4	79.8	101.9
MOS (Technology)	84.5	123.5	166.9	225.0	259.5	313.2
NMOS	30.1	77.1	107.1	151.0	173.9	207.3
PMOS	45.8	35.9	23.9	19.5	16.9	14.1
CMOS	8.6	10.5	35.9	54.5	68.7	91.8
MOS (Function)	84.5	123.5	166.9	225.0	259.5	313.2
MOS Memory			56.1	96.0	108.5	132.4
MOS Micro Device			46.6	61.1	89.3	110.6
MOS Logic			64.2	67.9	61.7	70.2
Linear	96.8	115.9	147.2	196.4	261.0	271.3
Total Discrete	213.1	198.6	194.7	223.8	273.3	240.5
Total Optoelectronic	18.0	21.7	30.8	44.6	58.5	63.8
Exchange Rate (Yen/US$)	269.0	210.0	210.0	227.0	221.0	248.0

Source: Dataquest
October 1986
Ref. 1086

Table 4b

JAPANESE SEMICONDUCTOR CONSUMPTION
(Billions of Yen)

	1983	1984	1985	1986	1987	1988
Total Semiconductor	1328.0	2096.5	2047.9	2007.3	2236.3	2688.0
Total IC	940.5	1589.2	1565.0	1547.0	1787.2	2190.6
Bipolar Digital (Technology)	146.7	236.8	227.7	223.3	261.5	306.0
TTL	65.6	111.4	104.2	101.0	113.0	129.0
ECL	51.0	83.2	85.0	88.9	109.3	133.6
Other Bipolar Digital	30.1	42.2	38.5	33.4	39.2	43.4
Bipolar Digital (Function)	146.7	236.8	227.7	223.3	261.5	306.0
Bipolar Digital Memory	13.9	31.3	29.9	26.8	30.4	33.5
Bipolar Digital Logic	132.8	205.5	197.8	196.5	231.1	272.5
MOS (Technology)	451.2	886.9	858.4	842.3	1049.0	1369.4
NMOS	303.4	571.9	539.1	478.9	536.1	595.8
PMOS	13.6	16.6	17.0	9.3	9.6	8.2
CMOS	134.2	298.4	302.3	354.1	503.3	765.4
MOS (Function)	451.2	886.9	858.4	842.3	1049.0	1369.4
MOS Memory	203.3	404.1	325.2	274.0	331.3	468.7
MOS Micro Device	139.6	216.4	221.1	242.7	295.8	377.4
MOS Logic	108.3	266.4	312.1	325.6	421.9	523.3
Linear	342.6	465.5	478.9	481.4	476.7	515.2
Total Discrete	297.8	395.7	372.7	338.1	323.6	352.9
Total Optoelectronic	89.7	111.6	110.2	122.2	125.5	144.5
Exchange Rate (Yen/US$)	235.0	237.0	238.0	166.0	155.0	155.0

Source: Dataquest
October 1986
Ref. 1086

Table 4c

JAPANESE SEMICONDUCTOR CONSUMPTION
(Billions of Yen)

	1989	1990	1991	CAGR (86-91)	1996	CAGR (91-96)
Total Semiconductor	2710.0	3219.2	3877.8	11.2%	8127.6	16.0%
Total IC	2218.2	2660.7	3236.4	12.9%	7081.8	17.0%
Bipolar Digital (Technology)	294.5	335.8	398.4	9.8%	716.9	12.5%
TTL	120.1	128.5	147.3	5.9%	215.0	7.9%
ECL	133.9	166.0	199.3	15.3%	444.5	17.4%
Other Bipolar Digital	40.5	41.3	51.8	5.1%	57.4	2.1%
Bipolar Digital (Function)	294.5	335.8	398.4	9.8%	716.9	12.5%
Bipolar Digital Memory	32.9	34.9	37.4	3.8%	48.8	5.5%
Bipolar Digital Logic	261.6	300.9	361.0	10.5%	668.1	13.1%
MOS (Technology)	1414.4	1767.7	2220.0	17.2%	5418.5	19.5%
NMOS	507.8	502.0	569.3	0.9%	886.9	8.8%
PMOS	5.6	5.4	4.9	-18.7%	3.9	-4.5%
CMOS	901.0	1260.3	1645.8	32.6%	4547.7	22.5%
MOS (Function)	1414.4	1767.7	2220.0	17.2%	5418.5	19.5%
MOS Memory	426.6	554.6	654.4	12.4%	1628.4	20.0%
MOS Micro Device	422.7	512.3	6696.7	21.1%	1600.7	18.1%
MOS Logic	565.1	700.8	868.9	18.6%	2189.4	20.3%
Linear	509.3	557.2	618.0	4.3%	946.4	8.9%
Total Discrete	348.9	391.0	442.2	2.9%	647.0	7.9%
Total Optoelectronic	142.9	167.5	199.2	10.4%	398.8	14.9%
Exchange Rate (Yen/US$)	155.0	155.0	155.0		155.0	

Source: Dataquest
October 1986
Ref. 1086

Consumption and Factory Shipments

Table 5a

WESTERN EUROPEAN SEMICONDUCTOR CONSUMPTION
(Millions of Dollars)

	1977	1978	1979	1980	1981	1982
Total Semiconductor	1886	2339	3018	3686	3041	3167
Total IC	904	1238	1747	2333	1892	1988
Bipolar Digital (Technology)	228	291	390	510	454	434
TTL						
ECL						
Other Bipolar Digital						
Bipolar Digital (Function)	228	291	390	510	454	434
Bipolar Digital Memory			85	116	103	100
Bipolar Digital Logic			305	394	351	334
MOS (Technology)	352	535	781	1139	882	948
NMOS						
PMOS						
CMOS						
MOS (Function)	352	535	781	1139	882	948
MOS Memory			367	543	426	469
MOS Micro Device			125	189	149	168
MOS Logic			289	407	307	311
Linear	324	412	576	684	556	606
Total Discrete	914	1004	1138	1192	995	1011
Total Optoelectronic	68	97	133	161	154	168

Source: Dataquest
October 1986
Ref. 1086

Consumption and Factory Shipments

Table 5b

WESTERN EUROPEAN SEMICONDUCTOR CONSUMPTION
(Millions of Dollars)

	1983	1984	1985	1986	1987	1988
Total Semiconductor	3370	4805	4720	5417	6200	7898
Total IC	2323	3634	3556	4088	4760	6323
Bipolar Digital (Technology)	483	724	709	782	908	1132
TTL						
ECL						
Other Bipolar Digital						
Bipolar Digital (Function)	483	724	709	782	908	1132
Bipolar Digital Memory	107	149	157	172	179	209
Bipolar Digital Logic	376	575	552	610	729	923
MOS (Technology)	1227	2092	1953	2280	2732	3899
NMOS						
PMOS						
CMOS						
MOS (Function)	1227	2092	1953	2280	2732	3899
MOS Memory	581	995	750	822	969	1393
MOS Micro Device	239	465	485	578	674	942
MOS Logic	407	632	718	880	1089	1564
Linear	613	818	894	1026	1120	1292
Total Discrete	866	963	954	1061	1144	1241
Total Optoelectronic	181	208	210	268	296	334

Source: Dataquest
October 1986
Ref. 1086

Table 5c

WESTERN EUROPEAN SEMICONDUCTOR CONSUMPTION
(Millions of Dollars)

	1989	1990	1991	CAGR (86-91)	1996	CAGR (91-96)
Total Semiconductor	8274	9356	11968	16.8%	25036	15.9%
Total IC	6608	7545	9908	18.6%	22207	17.5%
Bipolar Digital (Technology)	1090	1153	1410	12.1%	2748	14.3%
TTL						
ECL						
Other Bipolar Digital						
Bipolar Digital (Function)	1090	1153	1410	12.1%	2748	14.3%
Bipolar Digital Memory	204	213	245	7.7%	280	2.7%
Bipolar Digital Logic	886	940	1165	13.3%	2468	16.2%
MOS (Technology)	4194	5013	6852	23.3%	16760	19.6%
NMOS						
PMOS						
CMOS						
MOS (Function)	4194	5013	6852	23.3%	16760	19.6%
MOS Memory	1440	1715	2366	21.1%	4556	14.0%
MOS Micro Device	1121	1377	2018	26.8%	5256	21.1%
MOS Logic	1633	1921	2468	22.8%	6948	23.0%
Linear	1324	1379	1646	10.7%	2699	10.4%
Total Discrete	1329	1446	1621	9.2%	1935	3.6%
Total Optoelectronic	337	365	439	13.1%	895	15.3%

Source: Dataquest
October 1986
Ref. 1086

Consumption and Factory Shipments

Table 6a

REST OF WORLD SEMICONDUCTOR CONSUMPTION
(Millions of Dollars)

	1977	1978	1979	1980	1981	1982
Total Semiconductor	483	660	790	996	963	1042
Total IC	184	258	364	450	494	585
Bipolar Digital (Technology)	39	45	79	108	106	113
TTL						
ECL						
Other Bipolar Digital						
Bipolar Digital (Function)	39	45	79	108	106	113
Bipolar Digital Memory			2	3	3	4
Bipolar Digital Logic			77	105	103	109
MOS (Technology)	88	110	100	143	171	248
NMOS						
PMOS						
CMOS						
MOS (Function)	88	110	100	143	171	248
MOS Memory			25	34	51	106
MOS Micro Device			17	27	43	63
MOS Logic			58	82	77	79
Linear	57	103	185	199	217	224
Total Discrete	257	346	334	416	355	345
Total Optoelectronic	42	56	92	130	114	112

Source: Dataquest
October 1986
Ref. 1086

Table 6b

REST OF WORLD SEMICONDUCTOR CONSUMPTION
(Millions of Dollars)

	1983	1984	1985	1986	1987	1988
Total Semiconductor	1503	2298	1897	2919	4009	5425
Total IC	959	1474	1155	1886	2769	4008
Bipolar Digital (Technology)	162	246	131	212	280	359
TTL						
ECL						
Other Bipolar Digital						
Bipolar Digital (Function)	162	246	131	212	280	359
Bipolar Digital Memory	4	7	6	12	15	23
Bipolar Digital Logic	158	239	125	200	265	336
MOS (Technology)	450	825	627	1096	1716	2655
NMOS						
PMOS						
CMOS						
MOS (Function)	450	825	627	1096	1716	2655
MOS Memory	194	313	136	222	375	925
MOS Micro Device	112	164	135	283	455	610
MOS Logic	144	348	356	591	886	1120
Linear	347	403	397	578	773	994
Total Discrete	419	695	622	866	1037	1172
Total Optoelectronic	125	129	120	167	203	245

Source: Dataquest
October 1986
Ref. 1086

Table 6c

REST OF WORLD SEMICONDUCTOR CONSUMPTION
(Millions of Dollars)

	1989	1990	1991	CAGR (86-91)	1996	CAGR (91-96)
Total Semiconductor	5205	6092	7359	25.4%	18115	19.7%
Total IC	3757	4571	5681	30.4%	15281	21.9%
Bipolar Digital (Technology)	351	403	482	24.2%	1219	20.4%
TTL						
ECL						
Other Bipolar Digital						
Bipolar Digital (Function)	351	403	482	24.2%	1219	20.4%
Bipolar Digital Memory	25	28	32	32.2%	52	10.2%
Bipolar Digital Logic	326	375	450	23.8%	1167	21.0%
MOS (Technology)	2446	3128	4019	36.3%	11770	24.0%
NMOS						
PMOS						
CMOS						
MOS (Function)	2446	3128	4019	36.3%	11770	24.0%
MOS Memory	766	963	1173	43.2%	3875	27.0%
MOS Micro Device	580	778	1044	40.6%	2822	22.0%
MOS Logic	1100	1387	1802	31.0%	5073	23.0%
Linear	960	1040	1180	19.9%	2292	14.2%
Total Discrete	1194	1231	1338	13.6%	2234	10.8%
Total Optoelectronic	254	290	340	19.0%	600	12.0%

Source: Dataquest
October 1986
Ref. 1086

Consumption and Factory Shipments

Table 7a

WORLDWIDE AVERAGE SELLING PRICES
(Dollars)

	1977	1978	1979	1980	1981	1982
Total Semiconductor	0.28	0.29	0.30	0.32	0.31	0.33
Total IC	1.02	1.01	0.97	1.07	1.02	1.01
Bipolar Digital (Technology)	0.66	0.63	0.57	0.70	0.70	0.62
TTL						
ECL						
Other Bipolar Digital						
Bipolar Digital (Function)	0.66	0.63	0.57	0.70	0.70	0.62
Bipolar Digital Memory						
Bipolar Digital Logic						
MOS (Technology)	2.06	1.91	1.93	1.81	1.66	1.71
NMOS	4.46	4.46	3.66	3.08	3.06	2.91
PMOS	3.01	1.92	1.80	1.75	1.70	1.70
CMOS	0.76	0.64	0.78	0.79	0.74	0.78
MOS (Function)	2.06	1.91	1.93	1.81	1.66	1.71
MOS Memory	0.00	0.00	5.15	4.90	3.17	3.06
MOS Micro Device	0.00	0.00	3.96	3.61	3.40	3.34
MOS Logic	0.00	0.00	0.89	0.85	0.86	0.80
Linear	0.83	0.84	0.78	0.83	0.81	0.79
Total Discrete	0.14	0.13	0.12	0.12	0.11	0.11
Total Optoelectronic	0.45	0.47	0.51	0.44	0.39	0.38

Source: Dataquest
October 1986
Ref. 1086

Table 7b

WORLDWIDE AVERAGE SELLING PRICES
(Dollars)

Consumption and Factory Shipments

Table 7c

WORLDWIDE AVERAGE SELLING PRICES
(Dollars)

	1989	1990	1991	CAGR (86-91)	1996	CAGR (91-96)
Total Semiconductor	0.44	0.46	0.46	6.0%	0.62	6.0%
Total IC	1.41	1.50	1.59	8.4%	2.00	4.6%
Bipolar Digital (Technology)	0.86	0.90	0.91	5.1%	1.00	1.9%
TTL						
ECL						
Other Bipolar Digital						
Bipolar Digital (Function)	0.86	0.90	0.91	5.1%	1.00	1.9%
Bipolar Digital Memory						
Bipolar Digital Logic						
MOS (Technology)	2.16	2.30	2.36	7.1%	3.09	5.5%
NMOS	2.98	3.31	3.00	3.8%	3.00	0.0%
PMOS	1.76	1.76	1.79	0.5%	1.84	0.6%
CMOS	1.89	2.04	2.23	15.8%	3.09	6.7%
MOS (Function)	2.16	2.30	2.36	7.1%	3.09	5.5%
MOS Memory	2.76	3.18	3.20	4.8%	3.15	-0.3%
MOS Micro Device	3.94	3.59	3.50	-1.9%	3.04	-2.8%
MOS Logic	1.42	1.53	1.60	11.5%	3.08	14.0%
Linear	0.93	0.93	0.94	4.3%	1.00	1.2%
Total Discrete	0.09	0.09	0.08	-2.4%	0.08	-1.2%
Total Optoelectronic	0.38	0.37	0.34	0.4%	0.36	1.2%

Source: Dataquest
October 1986
Ref. 1086

Consumption and Factory Shipments

Table 8a

WORLDWIDE SEMICONDUCTOR CONSUMPTION
(Millions of Units)

	1977	1978	1979	1980	1981	1982
Total Semiconductor	25053	30986	37421	43800	47180	46264
Total IC	3703	5171	7242	8955	9809	10791
Bipolar Digital (Technology)	1506	2002	2937	3391	3339	3890
TTL						
ECL						
Other Bipolar Digital						
Bipolar Digital (Function)	1506	2002	2937	3391	3339	3890
Bipolar Digital Memory						
Bipolar Digital Logic						
MOS (Technology)	769	1221	1731	2603	2906	3306
NMOS	147	305	597	1041	1042	1341
PMOS	204	299	276	287	265	221
CMOS	418	617	858	1275	1598	1744
MOS (Function)	769	1221	1731	2603	2906	3306
MOS Memory			325	455	655	883
MOS Micro Device			137	239	319	395
MOS Logic			1269	1909	1933	2029
Linear	1428	1949	2574	2960	3564	3595
Total Discrete	20679	24917	29068	33288	35326	33314
Total Optoelectronic	671	898	1111	1557	2045	2159

Source: Dataquest
October 1986
Ref. 1086

Consumption and Factory Shipments

Table 8b

WORLDWIDE SEMICONDUCTOR CONSUMPTION
(Millions of Units)

	1983	1984	1985	1986	1987	1988
Total Semiconductor	60344	79853	71308	77845	84733	103503
Total IC	14110	20455	17857	19835	22432	26375
Bipolar Digital (Technology)	4612	7403	5351	5981	6552	7511
TTL						
ECL						
Other Bipolar Digital						
Bipolar Digital (Function)	4612	7403	5351	5981	6552	7511
Bipolar Digital Memory						
Bipolar Digital Logic						
MOS (Technology)	4665	6482	6234	6964	8348	10287
NMOS	1745	2405	2610	2498	2721	2884
PMOS	182	161	83	66	60	49
CMOS	2738	3917	3540	4399	5568	7354
MOS (Function)	4665	6482	6234	6964	8348	10287
MOS Memory	1150	1635	1586	1721	1927	2501
MOS Micro Device	592	739	715	850	1027	1316
MOS Logic	2923	4108	3933	4393	5395	6471
Linear	4833	6569	6272	6890	7531	8577
Total Discrete	43443	55882	49952	53660	57658	71451
Total Optoelectronic	2791	3516	3449	4350	4643	5678

Source: Dataquest
October 1986
Ref. 1086

Table 8c

WORLDWIDE SEMICONDUCTOR CONSUMPTION
(Millions of Units)

	1989	1990	1991	CAGR (86-91)	1996	CAGR (91-96)
Total Semiconductor	102688	112581	136923	13.9%	215850	9.5%
Total IC	25853	28298	33448	13.4%	58337	11.8%
Bipolar Digital (Technology)	7045	7430	8686	10.2%	14812	11.3%
TTL						
ECL						
Other Bipolar Digital						
Bipolar Digital (Function)	7045	7430	8686	10.2%	14812	11.3%
Bipolar Digital Memory						
Bipolar Digital Logic						
MOS (Technology)	10554	11955	14756	18.8%	28028	13.7%
NMOS	2679	2467	2517	-0.7%	230	-38.0%
PMOS	41	38	34	-16.4%	30	-2.5%
CMOS	7834	9450	12205	28.1%	27768	17.9%
MOS (Function)	10554	11955	14756	18.8%	28028	13.7%
MOS Memory	2777	2942	3589	17.7%	8425	18.6%
MOS Micro Device	1615	2133	2916	32.5%	8192	22.9%
MOS Logic	6161	6880	8251	16.0%	11411	6.7%
Linear	8255	8913	10006	9.8%	15497	9.1%
Total Discrete	71521	78222	95777	13.9%	143671	8.4%
Total Optoelectronic	5314	6061	7698	17.4%	13842	12.5%

Source: Dataquest
October 1986
Ref. 1086

Consumption and Factory Shipments

Table 9a

WORLDWIDE SEMICONDUCTOR FACTORY SHIPMENTS
(Millions of Dollars)

	1977	1978	1979	1980	1981
Total Semiconductor	6968	8953	11114	14118	14828
Total IC	3763	5230	7028	9546	10046
Bipolar Digital (Technology)	994	1261	1674	2374	2337
TTL	771	990	1365	1930	1823
ECL	95	138	170	300	376
Other Bipolar Digital	128	133	139	144	138
Bipolar Digital (Function)	994	1261	1674	2374	2337
Bipolar Digital Memory			324	572	558
Bipolar Digital Logic			1350	1802	1779
MOS (Technology)	1584	2332	3346	4715	4822
NMOS	655	1361	2184	3207	3190
PMOS	613	574	497	503	451
CMOS	316	397	665	1005	1181
MOS (Function)	1584	2332	3346	4715	4822
MOS Memory	704	996	1676	2230	2075
MOS Micro Device			541	862	1085
MOS Logic			1129	1623	1662
Linear	1185	1637	2008	2457	2887
Total Discrete	2903	3301	3522	3883	3985
Total Optoelectronic	302	422	564	689	797

Source: Dataquest
October 1986
Ref. 1086

Table 9b

WORLDWIDE SEMICONDUCTOR FACTORY SHIPMENTS
(Millions of Dollars)

	1982	1983	1984	1985	1986
Total Semiconductor	15261	19665	29087	24823	30642
Total IC	10894	14684	22753	18988	23508
Bipolar Digital (Technology)	2412	2998	4812	3799	4487
TTL	1889	2423	4067	3058	
ECL	391	445	607	607	
Other Bipolar Digital	132	130	138	134	
Bipolar Digital (Function)	2412	2998	4812	3799	4487
Bipolar Digital Memory	511	593	719	603	685
Bipolar Digital Logic	1901	2405	4093	3196	3801
MOS (Technology)	5642	8013	13014	10422	12890
NMOS	3902	5496	8850	6488	7231
PMOS	376	319	281	146	116
CMOS	1364	2198	3883	3788	5543
MOS (Function)	5642	8013	13014	10422	12890
MOS Memory	2701	3691	6261	4013	4353
MOS Micro Device	1318	2013	3261	2751	3485
MOS Logic	1623	2309	3492	3658	5052
Linear	2840	3673	4927	4767	6132
Total Discrete	3547	3949	5054	4670	5557
Total Optoelectronic	820	1032	1280	1165	1577

Source: Dataquest
October 1986
Ref. 1086

Consumption and Factory Shipments

Table 10

HISTORICAL NORTH AMERICAN SEMICONDUCTOR FACTORY SHIPMENTS
(Millions of Dollars)
1976 through 1985

Factory shipments were not available at time of publication. This section will be supplied at a late date.

Consumption and Factory Shipments

Table 11

HISTORICAL JAPANESE SEMICONDUCTOR FACTORY SHIPMENTS
(Millions of Dollars)
1976 through 1985

Factory shipments were not available at time of publication. This section will be supplied at a late date.

Consumption and Factory Shipments

Table 12

HISTORICAL JAPANESE SEMICONDUCTOR FACTORY SHIPMENTS
(Millions of Yen)
1976 through 1985

Factory shipments were not available at time of publication. This section will be supplied at a late date.

Consumption and Factory Shipments

Table 13

HISTORICAL EUROPEAN SEMICONDUCTOR FACTORY SHIPMENTS
(Millions of Dollars)
1976 through 1985

Factory shipments were not available at time of publication. This section will be supplied at a late date.

Consumption and Factory Shipments

Table 14

HISTORICAL REST OF WORLD SEMICONDUCTOR FACTORY SHIPMENTS
(Millions of Dollars)
1976 through 1985

Factory shipments were not available at time of publication. This section will be supplied at a late date.

Consumption and Shipment Data

The following is a list of the material in this section:

- Consumption and Factory Shipments
- Historical Consumption (Worldwide)
- Consumption Forecast (Worldwide)
- Historical Consumption (North American)
- Consumption Forecast (North American)
- Historical Consumption (Japanese)
- Consumption Forecast (Japanese)
- Historical Consumption (Japanese, Yen)
- Consumption Forecast (Japanese, Yen)
- Historical Consumption (Western European)
- Consumption Forecast (Western European)
- Historical Consumption (Rest of World)
- Consumption Forecast (Rest of World)
- Historical Average Selling Price (Worldwide)
- Average Selling Price Forecast (Worldwide)
- Historical Unit Consumption (Worldwide)
- Unit Consumption Forecast (Worldwide)
- Historical Factory Shipments (Worldwide)
- Historical Factory Shipments (North American)
- Historical Factory Shipments (Japanese)
- Historical Factory Shipments (Japanese, Yen)
- Historical Factory Shipments (Western European)
- Historical Factory Shipments (Rest of World)

Consumption and Factory Shipments

INTRODUCTION

Consumption/factory shipments data comprise a set of detailed tables that estimate semiconductor consumption and semiconductor factory shipments both worldwide and for four major geographical regions for the years 1976 through 1991 and 1996. Semiconductor consumption tables are divided into historical data tables and forecast tables. Semiconductor factory shipments tables are historical data tables only. All historical tables begin with 1976 and end with 1985, while all forecast tables provide annual market size estimates for 1984 through 1991, with additional estimates for 1996. Please refer to the "Forecast" section for a discussion of the differences between historical and future dollar values. A list of tables detailing the type of data, region, years and units, is as follows:

LIST OF TABLES--CONSUMPTION/FACTORY SHIPMENTS

Table	Region Covered	Years	Units
0	Japan, Western Europe Exchange Rates	1970-1985	Various
1	Worldwide Consumption	1976-1985	Dollars
2	Worldwide Consumption	1984-1991; 1996	Dollars
3	North America Consumption	1976-1985	Dollars
4	North America Consumption	1984-1991; 1996	Dollars
5	Japan Consumption	1976-1985	Dollars
6	Japan Consumption	1984-1991; 1996	Dollars
7	Japan Consumption	1976-1985	Yen
8	Japan Consumption	1984-1991; 1996	Yen
9	Western Europe Consumption	1976-1985	Dollars
10	Western Europe Consumption	1984-1991; 1996	Dollars
11	Rest of World Consumption	1976-1985	Dollars
12	Rest of World Consumption	1984-1991; 1996	Dollars
13	Worldwide Average Selling Price	1976-1985	Dollars
14	Worldwide Average Selling Price	1984-1991; 1996	Dollars
15	Worldwide Consumption	1976-1985	Units
16	Worldwide Consumption	1984-1991; 1996	Units
17	Worldwide Factory Shipments	1976-1985	Dollars
18	North America Factory Shipments	1976-1985	Dollars
19	Japan Factory Shipments	1976-1985	Dollars
20	Japan Factory Shipments	1976-1985	Yen
21	Western Europe Factory Shipments	1976-1985	Dollars
22	Rest of World Factory Shipments	1976-1985	Dollars

Consumption and Factory Shipments

Each table gives estimates of semiconductor consumption or factory shipments listed by the major semiconductor device product categories. In these tables, semiconductor components are divided into three major product groups: integrated circuits, discrete devices, and optoelectronic devices. These groups are divided into a number of subgroups, some of which are segmented further.

DEFINITIONS AND CONVENTIONS

DATAQUEST uses a common manufacturer base for all data tables. This base includes all suppliers to the merchant semiconductor market. It excludes captive suppliers that manufacture devices solely for the benefit of the parent company, such as AT&T Technologies (formerly Western Electric), Burroughs, and IBM. Included, however, are companies that actively market semiconductor devices to the merchant market as well as to other divisions of their own companies. A recent case in point is NCR, previously a captive supplier, which in 1982 offered products on the merchant market for the first time. For such companies, both external shipments and internal consumption are included. Devices that are used internally are valued at current market prices.

Consumption--DATAQUEST defines consumption as the purchase of a semiconductor device or devices. This definition must be differentiated from actual use of the device in a final product. Devices that are inventoried at the user level are considered consumption according to our definition.

Factory Shipments Location--The fabrication and assembly of a semiconductor device may be performed in several different locations. Factory shipment is defined as occurring from that point where the device was tested and marked, irrespective of where the device was assembled or where the initial wafer fabrication was performed.

Hybrids--In earlier consumption/factory shipment data, hybrid devices were included as a separate segment of integrated circuits. However, since hybrid devices are primarily a special packaging arrangement, this segment has been omitted. Hybrid devices manufactured by semiconductor companies are now included in the most appropriate product segment, usually the linear segment.

Power Devices--The difference between low-power and high-power transistors is set at the 1-watt power-handling capability. Power diodes are rated at 1 amp or higher; small-signal diodes are rated at less than 1 amp. Special discrete devices that are neither transistors, diodes, nor thyristors are categorized as "other discretes."

The manufacturer base product group definitions and guidelines for including value of output that we have used in our tables may differ from those used in other studies of this type. Our base is nearly the same as that used by the World Semiconductor Trade Statistics program (WSTS).

Regions--North America is defined as including both the United States and Canada. Latin America, including Mexico, is considered part of the Rest of World (ROW) category. Western Europe includes Austria, Belgium, the Federal Republic of Germany, France, Greece, Italy, Luxembourg, the Scandinavian countries (Denmark, Finland, Norway, Sweden), Spain, and the United Kingdom.

DATA SOURCES

The information presented in the consumption/factory shipment data has been consolidated from a variety of sources, each of which focuses on a specific part of the market. These sources include the following:

- U.S. Commerce Department trade statistics, World Semiconductor Trade Statistics (WSTS) data, and DATAQUEST's estimates of regional company sales are used to determine North American consumption and factory shipments.

- Japanese trade statistics compiled and published by the Ministry of Finance (MOF), and the Ministry of International Trade and Industry (MITI), WSTS data, and DATAQUEST's estimates of regional company sales are used to determine Japanese factory shipments and consumption.

- For West European markets, U.S. Department of Commerce trade statistics, marketing statistics from WSTS data, and DATAQUEST's estimates of regional company sales are used to determine factory shipments and consumption.

- In ROW, the major published sources used to estimate consumption and factory shipments are U.S. Department of Commerce and MITI trade statistics, WSTS data, and DATAQUEST's estimates of company shipments into the region.

Consumption and Factory Shipments

DATAQUEST believes that the estimates presented here are the most accurate and meaningful generally available today. The sources of the data and the guidelines for the forecasts presented in the tables are:

- Unit sales or revenues (or both) published by major industry participants, both in the United States and abroad
- Estimates presented by knowledgeable and reliable industry spokesmen
- Government data or trade association data such as those from the Electronics Industry Association (EIA), MITI, WSTS, and the U.S. Department of Commerce
- Published product literature and price lists
- Interviews with knowledgeable manufacturers, distributors, and users
- Relevant projected world economic data

CONSISTENCY

One of the key objectives in preparing these estimates is to achieve consistency among the various data elements that constitute the forecast and the historical data base. To ensure the accuracy and consistency of the estimates, we have compared the value of directly obtained data elements with values obtained by indirect means, wherever possible. Thus, the worldwide totals in the consumption/factory shipment analysis are consistent with the worldwide totals of the market share analysis. However, the regional factory shipment totals of the market share data do not and should not equal the regional factory shipments totals of the consumption/factory shipment tables because this latter analysis includes factories of all national origins producing in a given region. For example, factory shipments in Japan includes companies like Texas Instruments Japan.

ACCURACY

The tables presented here represent DATAQUEST estimates that we believe are reasonably accurate. Where we have no reasonable estimate, none is given. A blank space in a table indicates that a reasonably accurate estimate is unavailable, and a zero in a table represents an estimate.

Consumption and Factory Shipments

VALUATION OF CONSUMPTION AND FACTORY SHIPMENTS

Regional consumption and factory shipments are all expressed in U.S. dollars, (Japanese consumption and shipments are, however, also expressed in yen). To make the tables in this study useful in comparing different regions, it is necessary to express all values in a common currency and, because of the U.S. producers' large presence in international markets, the dollar is the preferred choice.

However, the choice of the U.S. dollar (or any single currency, for that matter) as the currency basis for the tables, brings with it some problems that require the readers' careful consideration in interpreting the data.

Inflation

All countries that participate significantly in international semiconductor markets suffered from an overall price inflation in the 1970s, continuing into the 1980s.

As a consequence, the dollar in a given year is not truly comparable with the dollar in any preceding year. Consumer and wholesale price indices and GNP deflators all measure price changes in various composite "market baskets" of goods. However, there is no price index that measures price changes of material, equipment, and labor inputs to the semiconductor industry. Indeed, the "mix" is changing so rapidly that what is used this year was sometimes unavailable last year, at any price. Nor is there a composite price index that measures price changes in aggregate semiconductor product. In an industry noted for its deflationary trends, this latter effect would tend to make the component purchaser's dollar worth more as time passed, in terms of electronic purchasing ability.

We have made no adjustments in the historical data to account for these inflationary and deflationary effects. The data are expressed in current dollars (dollars that include the inflation rate and exchange rates of the given year) for all historical data; comparisons between different years must be interpreted accordingly.

Average Selling Prices

When considering the worldwide average selling prices (ASPs) for semiconductor components, one must look at the price per function of a circuit, the complexity of the circuit, and the product mix according to this increasing complexity. It is true that one characteristic of the

semiconductor industry is that the price per function for integrated circuits has been dropping an average of 30 percent per year for the last 15 years. At the same time, circuits have become denser, resulting in an overall increase in the price of a device with a decreasing cost per function. Thus, Table 14 shows the worldwide ASPs increasing after many years of decreasing, due to the move toward higher-complexity devices. There are also regional differences in ASPs due to regional competition differences and the varying regional product consumption mix. The worldwide ASP is truly an aggregate measure and may differ significantly from ASPs in any specific market at any point in time.

Exchange Rates

Construction of the West European tables involves combining data from many countries, each of which has different and changing exchange rates. DATAQUEST uses Annual Foreign Exchange Rates for each year as published by The International Monetary Fund. As far as possible, we prepare our estimates in terms of local currencies before conversion to U.S. dollars. The exchange rates for major currencies can be found in Table 0 at the end of this introduction.

Japanese consumption and factory shipments are based on MITI data, which are originally expressed in yen. The Japanese data published in this study are expressed in both dollars (Tables 5, 6, and 19) and in yen (Tables 7, 8, and 20). The yen/dollar exchange rate used for each year can be found in Table 0. Because of the fluctuations in the exchange rate for the yen, the dollar values given tend to distort the growth rate of the Japanese market, but they do provide a useful basis for regional market size comparisons. However, the data in yen give a better picture of the real growth in the Japanese market.

FORECAST

As mentioned previously, historical data are expressed in current dollars or dollars that include the given year's inflation rate and exchange rates. However, the consumption forecasts, which appear in Tables 2, 4, 6, 8, 10, and 12, use constant dollars and exchange rates, with no allowance for inflation or variations in the rates of exchange between countries. All estimates for 1986 and beyond are made as if 1986 monetary conditions will continue through 1996 and, therefore, show the absolute year-to-year growth during this period.

Information on interregional trade and other analyses used in the preparation of these tables is available to DATAQUEST clients upon request.

Table 0

ANNUAL FOREIGN EXCHANGE RATES
(Expressed in U.S. Dollars)

Year	Japan (Dollars per Yen)	France (Dollars per French Franc)	West Germany (Dollars per Deutsche Mark)	United Kingdom (Dollars per Pound Sterling)
1970	$0.002795	$0.1808	$0.2740	$2.3810
1971	$0.002913	$0.1815	$0.2874	$2.4390
1972	$0.003311	$0.1984	$0.3135	$2.5000
1973	$0.003721	$0.2247	$0.3745	$2.4390
1974	$0.003427	$0.2079	$0.3861	$2.3256
1975	$0.003368	$0.2331	$0.4065	$2.2222
1976	$0.003376	$0.2092	$0.3968	$1.8182
1977	$0.003761	$0.2037	$0.4310	$1.7544
1978	$0.004857	$0.2217	$0.4975	$1.9231
1979	$0.004518	$0.2353	$0.5464	$2.1277
1980	$0.004449	$0.2364	$0.5495	$2.3256
1981	$0.004519	$0.1842	$0.4425	$1.0408
1982	$0.004022	$0.1522	$0.4115	$1.7544
1983	$0.004203	$0.1312	$0.3922	$1.4085
1984	$0.004219	$0.1144	$0.3509	$1.3333
1985	$0.004202	$0.1114	$0.3401	$1.2821

Source: The International Monetary Fund
DATAQUEST
May 1986

TABLE 1

HISTORICAL WORLDWIDE SEMICONDUCTOR CONSUMPTION
(Millions of Dollars)
1976 through 1985

	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	CAGR (76-85)
Total Semiconductor	5982	6968	8953	11114	14118	14828	15261	19665	29087	24735	17.1%
Total IC	3087	3763	5230	7028	9546	10046	10894	14684	22753	18875	22.3%
Bipolar Digital (Technology)	865	994	1261	1674	2374	2337	2412	2998	4812	3784	17.8%
TTL	682	771	990	1365	1930	1823	1889	2423	4067	3043	18.1%
ECL	76	95	138	170	300	376	391	445	607	607	26.0%
Other Bipolar Digital	107	128	133	139	144	138	132	130	138	134	2.5%
Bipolar Digital (Function)	865	994	1261	1674	2374	2337	2412	2998	4812	3784	17.8%
Bipolar Digital Memory				324	572	558	511	593	719	595	
Bipolar Digital Logic				1350	1802	1779	1901	2405	4093	3189	
MOS (Technology)	1239	1584	2332	3346	4715	4822	5642	8013	13014	10324	26.6%
NMOS	377	655	1361	2184	3207	3190	3902	5496	8850	6390	37.0%
PMOS	658	613	574	497	503	451	376	319	281	146	-15.4%
CMOS	204	316	397	665	1005	1181	1364	2198	3883	3788	38.3%
MOS (Function)	1239	1584	2332	3346	4715	4822	5642	8013	13014	10324	26.6%
MOS Memory				1676	2230	2075	2701	3691	6261	4008	
MOS Micro Device				541	862	1085	1318	2013	3261	2751	
MOS Logic				1129	1623	1662	1623	2309	3492	3565	
Linear	983	1185	1637	2008	2457	2887	2840	3673	4927	4767	19.2%
Total Discrete	2612	2903	3301	3522	3883	3985	3547	3949	5054	4676	6.7%
Transistor	1351	1460	1625	1696	1841	2019	1791	1946	2528	2280	6.0%
Small Signal Transistor	805	800	892	891	938	1096	953	1008	1285	1109	3.6%
Power Transistor	546	660	733	805	903	923	838	938	1243	1171	8.8%
Diode	896	1001	1184	1277	1441	1417	1249	1446	1792	1621	6.8%
Small Signal Diode	281	311	370	437	478	454	393	459	537	486	6.3%
Power Diode	496	563	663	688	786	771	665	794	992	892	6.7%
Zener Diode	119	127	151	152	177	192	191	193	263	243	8.3%
Thyristor	242	300	339	365	401	356	315	314	438	445	7.0%
Other Discrete	123	142	153	184	200	193	192	243	296	330	11.6%
Total Optoelectronic	283	302	422	564	689	797	820	1032	1280	1184	17.2%
LED Lamps	53	73	101	119	136	180	187	245	277	249	18.8%
LED Displays	148	139	187	234	268	285	286	363	453	421	12.3%
Optical Couplers	29	34	52	80	100	122	129	152	189	173	22.0%
Other Optoelectronics	53	56	82	131	185	210	218	272	361	341	23.0%

Source: DATAQUEST
May 1986

TABLE 2

WORLDWIDE SEMICONDUCTOR CONSUMPTION FORECAST
(Millions of Dollars)
1984 through 1991, plus 1996

	1984	1985	1986	1987	1988	1989	1990	1991	CAGR (1985-91)	1996	CAGR (1991-96)
Total Semiconductor	29887	24735	28821	38163	47346	46357	55458	67906	18.3%	152562	17.6%
Total Integrated Circuit	22753	18675	21941	30498	38670	37848	46108	57264	20.3%	135858	18.7%
Bipolar Digital (Technology)	4812	3784	4884	5109	6011	5747	6453	7523	12.1%	14203	13.6%
TTL											
ECL											
Other Bipolar Digital											
Bipolar Digital (Function)	4812	3784	4884	5109	6011	5747	6453	7523	12.1%	14203	13.6%
Bipolar Digital Memory	719	595	642	744	833	820	862	912	7.4%	1120	4.2%
Bipolar Digital Logic	4093	3189	3442	4365	5178	4927	5591	6611	12.9%	13083	14.6%
MOS (Technology)	13814	10324	12182	18207	24046	23626	29066	38398	24.5%	99929	21.1%
NMOS	8850	6398	6829	8998	10253	8197	8693	8539	5.6%	6494	-5.3%
PMOS	281	146	116	105	87	72	67	61	-13.5%	55	-2.0%
CMOS	3883	3788	5240	9103	13706	15357	20906	29798	41.0%	93380	25.7%
MOS (Function)	13814	10324	12182	18207	24046	23626	29066	38398	24.5%	99929	21.1%
MOS Memory	6261	4068	4583	7348	10033	8935	11089	14055	23.3%	33082	18.7%
MOS Micro Device	3261	2751	3355	5055	6734	6939	8965	11761	27.4%	31172	21.5%
MOS Logic	3492	3565	4244	5804	7279	7752	9812	12582	23.4%	35675	23.2%
Linear	4927	4767	5675	7182	8613	8475	9789	11343	15.5%	20918	13.0%
Total Discrete	5854	4676	5401	5924	6625	6497	7009	7895	9.1%	12001	8.7%
Transistor	2528	2288	2619	2909	3272	3339	3656	4155	10.5%	6827	10.4%
Small Signal Transistor	1285	1189	1313	1458	1574	1624	1765	2017	10.5%	3293	10.3%
Power Transistor	1243	1171	1306	1451	1698	1715	1891	2138	10.6%	3534	10.6%
Diode	1792	1621	1909	2072	2278	2159	2368	2572	8.0%	3528	6.5%
Small Signal Diode	537	486	545	567	626	572	622	689	6.0%	826	3.7%
Power Diode	992	892	1069	1215	1313	1262	1367	1550	9.6%	2250	7.7%
Zener Diode	263	243	275	290	339	325	319	333	5.4%	452	6.3%
Thyristor	438	445	507	539	606	536	519	542	3.3%	645	3.5%
Other Discrete	296	330	366	404	469	463	526	626	11.3%	1001	9.8%
Total Optoelectronic	1288	1184	1479	1741	2051	2012	2341	2749	15.1%	5511	14.9%
LED Lamps	277	249	309	346	392	360	433	509	12.7%	988	14.2%
LED Displays	453	421	509	582	676	642	737	846	12.3%	1507	12.2%
Optical Couplers	189	173	218	256	305	323	379	451	17.3%	942	15.9%
Other Optoelectronics	361	341	441	557	678	687	792	943	18.5%	2074	17.1%

Source: DATAQUEST
May 1986

TABLE 3

HISTORICAL NORTH AMERICAN SEMICONDUCTOR CONSUMPTION
(Millions of Dollars)
1976 through 1985

	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	CAGR (76-85)
Total Semiconductor	2423	2876	3506	4538	6053	6529	6970	9141	13139	9607	16.5%
Total IC	1490	1811	2335	3179	4562	4867	5466	7400	10940	7710	20.0%
Bipolar Digital (Technology)	470	537	666	901	1411	1339	1367	1729	2843	2006	17.5%
TTL											
ECL											
Other Bipolar Digital											
Bipolar Digital (Function)	470	537	666	901	1411	1339	1367	1729	2843	2006	17.5%
Bipolar Digital Memory				185	396	375	320	423	431	315	
Bipolar Digital Logic				716	1015	964	1047	1306	2412	1691	
MOS (Technology)	640	830	1099	1703	2442	2595	3183	4416	6355	4247	23.4%
NMOS											
PMOS											
CMOS											
MOS (Function)	640	830	1099	1703	2442	2595	3183	4416	6355	4247	23.4%
MOS Memory				1028	1239	1107	1592	2051	3248	1774	
MOS Micro Device				186	377	489	641	1068	1719	1195	
MOS Logic				489	835	999	950	1297	1388	1278	
Linear	380	444	570	575	709	933	916	1255	1742	1457	16.1%
Total Discrete	769	940	1005	1161	1289	1398	1221	1397	1727	1528	7.6%
Transistor	400	486	515	545	572	690	611	630	732	672	5.9%
Small Signal Transistor	208	228	251	254	264	341	304	296	347	294	3.9%
Power Transistor	192	258	264	291	308	349	307	334	385	378	7.8%
Diode	265	295	310	417	483	484	434	555	701	592	9.3%
Small Signal Diode	65	64	55	76	92	92	77	123	146	125	7.5%
Power Diode	153	174	191	264	306	288	245	319	409	333	9.0%
Zener Diode	47	57	64	77	85	104	112	113	146	134	12.3%
Thyristor	83	115	130	139	159	154	129	136	204	186	9.4%
Other Discrete	41	44	50	60	75	70	47	76	90	78	7.4%
Total Optoelectronic	144	125	166	198	202	264	283	344	472	369	11.0%
LED Lamps	15	24	32	28	20	42	39	57	88	61	16.9%
LED Displays	90	62	81	75	63	71	74	100	154	127	3.9%
Optical Couplers	17	19	24	42	48	70	71	76	94	70	17.0%
Other Optoelectronics	22	20	29	53	71	81	99	111	136	111	19.7%

Source: DATAQUEST
May 1986

TABLE 4

NORTH AMERICAN SEMICONDUCTOR CONSUMPTION FORECAST
(Millions of Dollars)
1984 through 1991, plus 1996

	1984	1985	1986	1987	1988	1989	1990	1991	CAGR (1985-91)	1996	CAGR (1991-96)
Total Semiconductor	13139	9607	10667	14330	17799	16575	19669	23977	16.5%	52773	17.1%
Total Integrated Circuit	10940	7710	8509	11777	14851	13773	16506	20285	17.5%	46313	18.0%
Bipolar Digital (Technology)	2843	2006	2062	2534	2942	2733	3030	3495	9.7%	6229	12.3%
TTL											
ECL											
Other Bipolar Digital											
Bipolar Digital (Function)	2843	2006	2062	2534	2942	2733	3030	3495	9.7%	6229	12.3%
Bipolar Digital Memory	431	315	346	402	448	439	461	489	7.6%	613	4.6%
Bipolar Digital Logic	2412	1691	1716	2132	2494	2294	2569	3006	10.1%	5616	13.3%
MOS (Technology)	6355	4247	4846	7318	9482	8750	10727	13409	21.1%	32738	19.5%
NMOS											
PMOS											
CMOS											
MOS (Function)	6355	4247	4846	7318	9482	8750	10727	13409	21.1%	32738	19.5%
MOS Memory	3248	1774	1876	3057	4066	3497	4266	5333	20.1%	11309	16.2%
MOS Micro Device	1719	1195	1399	2109	2748	2638	3245	4056	22.6%	10549	21.1%
MOS Logic	1388	1278	1571	2152	2668	2615	3216	4020	21.0%	10880	22.0%
Linear	1742	1457	1601	1925	2427	2290	2749	3381	15.1%	7346	16.8%
Total Discrete	1727	1528	1682	1946	2198	2089	2319	2667	9.7%	4206	9.5%
Transistor	732	672	730	863	982	986	1119	1309	11.8%	2269	11.6%
Small Signal Transistor	347	294	333	377	425	437	514	623	13.3%	1032	10.6%
Power Transistor	385	378	397	486	557	549	605	686	10.4%	1237	12.5%
Diode	701	592	660	772	857	785	851	954	8.3%	1342	7.1%
Small Signal Diode	146	125	147	167	199	173	193	222	10.0%	274	4.3%
Power Diode	409	333	368	456	478	441	488	558	9.0%	828	8.2%
Zener Diode	146	134	145	149	180	171	170	174	4.4%	240	6.6%
Thyristor	204	186	203	208	232	190	185	186	0.0%	201	1.6%
Other Discrete	90	78	89	103	127	128	164	218	18.7%	394	12.6%
Total Optoelectronic	472	369	476	607	750	713	844	1025	18.6%	2254	17.1%
LED Lamps	88	61	84	105	125	114	140	175	19.2%	382	16.9%
LED Displays	154	127	153	182	225	207	245	287	14.6%	586	15.3%
Optical Couplers	94	70	91	107	134	133	159	196	18.7%	435	17.3%
Other Optoelectronics	136	111	148	213	266	259	300	367	22.1%	851	18.3%

Source: DATAQUEST
May 1986

TABLE 5

HISTORICAL JAPANESE SEMICONDUCTOR CONSUMPTION
(Millions of Dollars)
1976 through 1985

	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	CAGR (76-85)
Total Semiconductor	1632	1723	2448	2768	3383	4295	4082	5651	8845	8599	20.3%
Total IC	787	864	1399	1738	2201	2793	2855	4002	6705	6567	26.6%
Bipolar Digital (Technology)	174	190	259	304	345	438	498	624	999	953	20.8%
TTL											
ECL											
Other Bipolar Digital											
Bipolar Digital (Function)	174	190	259	304	345	438	498	624	999	953	20.8%
Bipolar Digital Memory				52	57	77	87	59	132	125	
Bipolar Digital Logic				252	288	361	411	565	867	828	
MOS (Technology)	306	314	588	762	991	1174	1263	1920	3742	3595	31.5%
NMOS											
PMOS											
CMOS											
MOS (Function)	306	314	588	762	991	1174	1263	1920	3742	3595	31.5%
MOS Memory				256	423	491	534	865	1705	1353	
MOS Micro Device				213	269	404	446	594	913	936	
MOS Logic				293	299	279	283	461	1124	1306	
Linear	307	360	552	672	865	1181	1094	1458	1964	2019	23.3%
Total Discrete	801	792	946	889	986	1237	970	1267	1669	1566	7.7%
Transistor	459	431	483	440	488	656	503	674	908	766	5.9%
Small Signal Transistor	305	275	299	268	290	391	252	334	405	329	0.8%
Power Transistor	154	156	184	172	198	265	251	340	503	437	12.3%
Diode	251	259	348	322	367	455	361	478	602	556	9.2%
Small Signal Diode	81	77	96	86	110	177	150	195	242	219	11.7%
Power Diode	148	159	222	204	217	234	180	246	310	287	7.6%
Zener Diode	22	23	30	32	40	44	31	37	50	50	9.6%
Thyristor	52	57	63	72	74	62	48	50	69	106	8.2%
Other Discrete	39	45	52	55	57	64	58	65	90	138	15.1%
Total Optoelectronic	44	67	103	141	196	265	257	382	471	466	30.0%
LED Lamps	8	7	16	21	32	58	71	107	103	101	32.5%
LED Displays	24	36	47	63	89	111	99	147	173	171	24.4%
Optical Couplers	4	6	10	13	17	19	22	34	43	42	29.9%
Other Optoelectronics	8	18	30	44	58	77	65	94	152	152	38.7%

Source: DATAQUEST
May 1986

TABLE 6

JAPANESE SEMICONDUCTOR CONSUMPTION FORECAST
(Millions of Dollars)
1984 through 1991, plus 1996

	1984	1985	1986	1987	1988	1989	1990	1991	CAGR (1985-91)	1996	CAGR (1991-96)
Total Semiconductor	8845	8599	11034	14425	17840	17825	21699	26805	20.9%	61699	18.1%
Total Integrated Circuit	6705	6567	8496	11870	15010	15026	18557	23238	23.4%	56138	19.3%
Bipolar Digital (Technology)	999	953	1164	1462	1702	1638	1865	2213	15.1%	4361	14.5%
TTL											
ECL											
Other Bipolar Digital											
Bipolar Digital (Function)	999	953	1164	1462	1702	1638	1865	2213	15.1%	4361	14.5%
Bipolar Digital Memory	132	125	139	160	166	163	169	178	6.1%	223	4.6%
Bipolar Digital Logic	867	828	1025	1302	1536	1475	1696	2035	16.2%	4138	15.3%
MOS (Technology)	3742	3595	4600	6811	9100	9228	11928	15642	27.8%	42944	22.4%
NMOS											
PMOS											
CMOS											
MOS (Function)	3742	3595	4600	6811	9100	9228	11928	15642	27.8%	42944	22.4%
MOS Memory	1705	1353	1715	2622	3697	3327	4192	5366	25.8%	13956	21.1%
MOS Micro Device	913	936	1233	1894	2557	2685	3652	4967	32.1%	13442	22.0%
MOS Logic	1124	1306	1652	2295	2846	3216	4084	5309	26.3%	15546	24.0%
Linear	1964	2019	2732	3597	4208	4160	4764	5383	17.8%	8833	10.4%
Total Discrete	1669	1566	1951	1911	2083	2060	2307	2607	8.9%	3915	8.5%
Transistor	908	766	948	946	1047	1078	1214	1379	10.3%	2306	10.8%
Small Signal Transistor	405	329	436	421	444	458	520	585	10.1%	1003	11.4%
Power Transistor	503	437	512	525	603	620	694	794	10.5%	1303	10.4%
Diode	602	556	731	700	741	707	795	899	8.3%	1138	4.8%
Small Signal Diode	242	219	254	240	257	236	274	304	5.6%	363	3.6%
Power Diode	310	287	412	400	415	403	455	526	10.6%	689	5.5%
Zener Diode	50	50	65	60	69	68	66	69	5.5%	86	4.5%
Thyristor	69	106	132	129	141	125	123	125	2.8%	124	-0.2%
Other Discrete	90	138	140	136	154	150	175	204	6.7%	347	11.2%
Total Optoelectronic	471	466	587	644	747	739	835	960	12.8%	1646	11.4%
LED Lamps	103	101	126	132	146	130	154	174	9.5%	262	8.5%
LED Displays	173	171	213	230	282	255	284	321	11.1%	461	7.5%
Optical Couplers	43	42	52	57	67	79	91	103	16.1%	169	10.4%
Other Optoelectronics	152	152	196	225	272	275	306	362	15.6%	754	15.8%

Source: DATAQUEST
May 1986

TABLE 7

HISTORICAL JAPANESE SEMICONDUCTOR CONSUMPTION
(Billions of Yen)
1976 through 1985

	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	CAGR (76-85)
Total Semiconductor	483.2	463.5	514.1	606.2	768.1	949.1	1012.3	1328.0	2096.5	2046.5	17.4%
Total IC	233.0	232.4	293.8	380.7	499.7	617.3	708.0	940.5	1589.2	1563.0	23.6%
Bipolar Digital (Technology)	51.5	51.1	54.4	66.6	78.3	96.8	123.5	146.7	236.8	226.9	17.9%
TTL											
ECL											
Other Bipolar Digital											
Bipolar Digital (Function)	51.5	51.1	54.4	66.6	78.3	96.8	123.5	146.7	236.8	226.9	17.9%
Bipolar Digital Memory				11.4	12.9	17.0	21.6	13.9	31.3	29.8	
Bipolar Digital Logic				55.2	65.4	79.8	101.9	132.8	205.5	197.1	
MOS (Technology)	90.6	84.5	123.5	166.9	225.0	259.5	313.2	451.2	886.9	855.6	28.3%
NMOS											
PMOS											
CMOS											
MOS (Function)	90.6	84.5	123.5	166.9	225.0	259.5	313.2	451.2	886.9	855.6	28.3%
MOS Memory				56.1	96.0	108.5	132.4	203.3	404.1	322.0	
MOS Micro Device				46.6	61.1	89.3	110.6	139.6	216.4	222.8	
MOS Logic				64.2	67.9	61.7	70.2	108.3	266.4	310.8	
Linear	90.9	96.8	115.9	147.2	196.4	261.0	271.3	342.6	465.5	480.5	20.3%
Total Discrete	237.1	213.1	198.6	194.7	223.8	273.3	240.5	297.8	395.7	372.6	5.2%
Transistor	135.9	116.0	101.4	96.4	110.7	145.0	124.7	158.4	215.2	182.3	3.3%
Small Signal Transistor	90.3	74.0	62.8	58.7	65.8	86.4	62.5	78.5	96.0	78.3	-1.6%
Power Transistor	45.6	42.0	38.6	37.7	44.9	58.6	62.2	79.9	119.2	104.0	9.6%
Diode	74.3	69.7	73.1	70.5	83.4	100.5	89.5	112.3	142.8	132.3	6.6%
Small Signal Diode	24.0	20.7	20.2	18.8	25.0	39.1	37.2	45.8	57.4	52.1	9.0%
Power Diode	43.8	42.8	46.6	44.7	49.3	51.7	44.6	57.8	73.5	68.3	5.1%
Zener Diode	6.5	6.2	6.3	7.0	9.1	9.7	7.7	8.7	11.9	11.9	7.0%
Thyristor	15.4	15.3	13.2	15.8	16.8	13.7	11.9	11.8	16.4	25.2	5.6%
Other Discrete	11.5	12.1	10.9	12.0	12.9	14.1	14.4	15.3	21.3	32.8	12.4%
Total Optoelectronic	13.1	18.0	21.7	30.8	44.6	58.5	63.8	89.7	111.6	110.9	26.8%
LED Lamps	2.4	1.9	3.4	4.6	7.3	12.8	17.6	25.1	24.4	24.0	29.2%
LED Displays	7.1	9.7	9.9	13.8	20.2	24.5	24.6	34.5	41.0	40.7	21.4%
Optical Couplers	1.2	1.6	2.1	2.8	3.9	4.2	5.5	8.0	10.2	10.0	26.6%
Other Optoelectronics	2.4	4.8	6.3	9.6	13.2	17.0	16.1	22.1	36.0	36.2	35.2%
Exchange Rate (Yen/US$)	296.0	269.0	210.0	219.0	227.0	221.0	248.0	235.0	237.0	238.0	

Source: DATAQUEST
May 1986

TABLE 8

JAPANESE SEMICONDUCTOR CONSUMPTION FORECAST
(Billions of Yen)
1984 through 1991, plus 1996

	1984	1985	1986	1987	1988	1989	1990	1991	CAGR (1985-91)	1996	CAGR (1991-96)
Total Semiconductor	2096.5	2046.5	2239.9	2928.5	3621.4	3618.6	4405.2	5441.4	17.7%	12525.0	18.1%
Total Integrated Circuit	1589.2	1563.0	1724.7	2409.7	3047.0	3050.3	3767.2	4717.2	20.2%	11396.0	19.3%
Bipolar Digital (Technology)	236.8	226.9	236.3	296.8	345.5	332.5	378.6	449.2	12.1%	885.3	14.5%
TTL											
ECL											
Other Bipolar Digital											
Bipolar Digital (Function)	236.8	226.9	236.3	296.8	345.5	332.5	378.6	449.2	12.1%	885.3	14.5%
Bipolar Digital Memory	31.3	29.8	28.2	32.5	33.7	33.1	34.3	36.1	3.2%	45.3	4.6%
Bipolar Digital Logic	205.5	197.1	208.1	264.3	311.8	299.4	344.3	413.1	13.1%	840.0	15.3%
MOS (Technology)	886.9	855.6	933.8	1382.7	1847.3	1873.3	2421.5	3175.3	24.4%	8717.6	22.4%
NMOS											
PMOS											
CMOS											
MOS (Function)	886.9	855.6	933.8	1382.7	1847.3	1873.3	2421.5	3175.3	24.4%	8717.6	22.4%
MOS Memory	404.1	322.0	348.1	532.3	750.5	675.4	851.0	1089.3	22.5%	2833.1	21.1%
MOS Micro Device	216.4	222.8	250.3	384.5	519.1	545.1	741.4	1008.3	28.6%	2728.7	22.0%
MOS Logic	266.4	310.8	335.4	465.9	577.7	652.8	829.1	1077.7	23.0%	3155.8	24.0%
Linear	465.5	480.5	554.6	730.2	854.2	844.5	967.1	1092.7	14.7%	1793.1	10.4%
Total Discrete	395.7	372.6	396.0	388.0	422.8	418.3	468.4	529.3	6.0%	794.8	8.5%
Transistor	215.2	182.3	192.4	192.1	212.5	218.9	246.5	280.0	7.4%	468.1	10.8%
Small Signal Transistor	96.0	78.3	88.5	85.5	90.1	93.0	105.6	118.8	7.2%	203.6	11.4%
Power Transistor	119.2	104.0	103.9	106.6	122.4	125.9	140.9	161.2	7.6%	264.5	10.4%
Diode	142.8	132.3	148.4	142.1	150.4	143.5	161.4	182.5	5.5%	231.1	4.8%
Small Signal Diode	57.4	52.1	51.6	48.7	52.2	47.9	55.6	61.7	2.9%	73.7	3.6%
Power Diode	73.5	68.3	83.6	81.2	84.2	81.8	92.4	106.8	7.7%	139.9	5.5%
Zener Diode	11.9	11.9	13.2	12.2	14.0	13.8	13.4	14.0	2.7%	17.5	4.6%
Thyristor	16.4	25.2	26.8	26.2	28.6	25.4	25.0	25.4	0.1%	25.2	-0.2%
Other Discrete	21.3	32.8	28.4	27.6	31.3	30.5	35.5	41.4	4.0%	70.4	11.2%
Total Optoelectronic	111.6	110.9	119.2	130.8	151.6	150.0	169.6	194.9	9.9%	334.2	11.4%
LED Lamps	24.4	24.0	25.6	26.8	29.6	26.4	31.3	35.3	6.6%	53.2	8.5%
LED Displays	41.0	40.7	43.2	46.7	53.2	51.8	57.7	65.2	8.2%	93.6	7.5%
Optical Couplers	10.2	10.0	10.6	11.6	13.6	16.0	18.5	20.9	13.1%	34.3	10.4%
Other Optoelectronics	36.0	36.2	39.8	45.7	55.2	55.8	62.1	73.5	12.5%	153.1	15.8%
Exchange Rate (Yen/US$)	237.0	238.0	203.0	203.0	203.0	203.0	203.0	203.0		203.0	

Source: DATAQUEST
May 1986

TABLE 9

HISTORICAL WESTERN EUROPEAN SEMICONDUCTOR CONSUMPTION
(Millions of Dollars)
1976 through 1985

	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	CAGR (76-85)
Total Semiconductor	1594	1886	2339	3018	3686	3041	3167	3370	4805	4632	12.6%
Total IC	676	904	1238	1747	2333	1892	1988	2323	3634	3443	19.8%
Bipolar Digital (Technology)	186	228	291	390	510	454	434	483	724	694	15.8%
TTL											
ECL											
Other Bipolar Digital											
Bipolar Digital (Function)	186	228	291	390	510	454	434	483	724	694	15.8%
Bipolar Digital Memory				85	116	103	100	107	149	149	
Bipolar Digital Logic				305	394	351	334	376	575	545	
MOS (Technology)	226	352	535	781	1139	882	948	1227	2092	1855	26.4%
NMOS											
PMOS											
CMOS											
MOS (Function)	226	352	535	781	1139	882	948	1227	2092	1855	26.4%
MOS Memory				367	543	426	469	581	995	745	
MOS Micro Device				125	189	149	168	239	465	485	
MOS Logic				289	407	307	311	407	632	625	
Linear	264	324	412	576	684	556	606	613	818	894	14.5%
Total Discrete	851	914	1004	1138	1192	995	1011	866	963	960	1.3%
Transistor	400	424	463	511	511	463	468	408	450	451	1.3%
Small Signal Transistor	248	244	265	286	275	251	247	210	223	214	-1.6%
Power Transistor	152	180	198	225	236	212	221	198	227	237	5.1%
Diode	318	352	402	460	503	384	391	327	358	354	1.2%
Small Signal Diode	117	143	182	228	225	157	154	125	132	126	0.8%
Power Diode	163	176	184	194	231	192	202	174	193	196	2.1%
Zener Diode	38	33	36	38	47	35	35	28	33	32	-1.9%
Thyristor	99	105	110	118	133	103	105	91	103	103	0.4%
Other Discrete	34	33	29	49	45	45	47	40	52	52	4.8%
Total Optoelectronic	67	68	97	133	161	154	168	181	208	229	14.6%
LED Lamps	23	27	35	42	41	41	44	45	55	54	9.9%
LED Displays	22	26	41	54	58	57	65	66	70	76	14.8%
Optical Couplers	5	6	10	19	27	27	28	32	40	49	28.9%
Other Optoelectronics	17	9	11	18	35	29	31	38	43	50	12.7%

Source: DATAQUEST
May 1986

TABLE 18

WESTERN EUROPEAN SEMICONDUCTOR CONSUMPTION FORECAST
(Millions of Dollars)
1984 through 1991, plus 1996

	1984	1985	1986	1987	1988	1989	1990	1991	CAGR (1985-91)	1996	CAGR (1991-96)
Total Semiconductor	4805	4632	4923	6391	7947	8274	9809	11968	17.1%	25414	16.3%
Total Integrated Circuit	3634	3443	3679	5008	6460	6776	8266	10264	20.0%	23009	17.5%
Bipolar Digital (Technology)	724	694	695	886	1100	1118	1262	1460	13.2%	2868	14.5%
TTL											
ECL											
Other Bipolar Digital											
Bipolar Digital (Function)	724	694	695	886	1100	1118	1262	1460	13.2%	2868	14.5%
Bipolar Digital Memory	149	149	150	173	209	209	222	233	7.7%	266	2.7%
Bipolar Digital Logic	575	545	545	713	891	909	1040	1227	14.5%	2602	16.2%
MOS (Technology)	2092	1855	2074	3005	4039	4300	5494	7098	25.1%	17341	19.6%
NMOS											
PMOS											
CMOS											
MOS (Function)	2092	1855	2074	3005	4039	4300	5494	7098	25.1%	17341	19.6%
MOS Memory	995	745	797	1220	1659	1567	1945	2451	22.0%	4726	14.0%
MOS Micro Device	465	485	561	824	1114	1306	1659	2190	28.6%	5697	21.1%
MOS Logic	632	625	716	961	1266	1427	1890	2457	25.6%	6918	23.0%
Linear	818	894	910	1117	1321	1358	1510	1706	11.4%	2800	10.4%
Total Discrete	963	960	995	1097	1170	1161	1161	1265	4.7%	1512	3.6%
Transistor	450	451	465	511	543	541	548	606	5.0%	685	2.5%
Small Signal Transistor	223	214	212	226	230	223	222	244	2.2%	208	-3.1%
Power Transistor	227	237	253	285	313	318	326	362	7.3%	477	5.7%
Diode	358	354	370	410	437	433	428	460	4.5%	555	3.8%
Small Signal Diode	132	126	124	133	136	130	122	126	0.0%	121	-0.8%
Power Diode	193	196	213	239	261	263	265	290	6.7%	382	5.7%
Zener Diode	33	32	33	38	40	40	41	44	5.5%	52	3.4%
Thyristor	103	103	107	117	128	128	129	140	5.2%	200	7.4%
Other Discrete	52	52	53	59	62	59	56	59	2.1%	72	4.1%
Total Optoelectronic	208	229	249	286	317	337	382	439	11.5%	893	15.3%
LED Lamps	55	54	55	60	65	65	71	81	7.0%	169	15.8%
LED Displays	70	76	78	83	88	88	95	107	5.9%	180	11.0%
Optical Couplers	40	49	57	69	77	83	94	111	14.6%	241	16.8%
Other Optoelectronics	43	50	59	74	87	101	122	140	18.7%	303	16.7%

Source: DATAQUEST
May 1986

TABLE 11

HISTORICAL REST OF WORLD SEMICONDUCTOR CONSUMPTION
(Millions of Dollars)
1976 through 1985

	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	CAGR (76-85)
Total Semiconductor	333	483	660	790	996	963	1042	1503	2298	1897	21.3%
Total IC	134	184	258	364	450	494	585	959	1474	1155	27.0%
Bipolar Digital (Technology)	35	39	45	79	108	106	113	162	246	131	15.8%
TTL											
ECL											
Other Bipolar Digital											
Bipolar Digital (Function)	35	39	45	79	108	106	113	162	246	131	15.8%
Bipolar Digital Memory				2	3	3	4	4	7	6	
Bipolar Digital Logic				77	105	103	109	158	239	125	
MOS (Technology)	67	88	110	100	143	171	248	450	825	627	28.2%
NMOS											
PMOS											
CMOS											
MOS (Function)	67	88	110	100	143	171	248	450	825	627	28.2%
MOS Memory				25	34	51	106	194	313	136	
MOS Micro Device				17	27	43	63	112	164	135	
MOS Logic				58	82	77	79	144	348	356	
Linear	32	57	103	185	199	217	224	347	403	397	32.3%
Total Discrete	171	257	346	334	416	355	345	419	695	622	15.4%
Transistor	92	119	164	200	270	210	209	234	438	391	17.4%
Small Signal Transistor	44	53	77	83	109	113	150	168	310	272	22.4%
Power Transistor	48	66	87	117	161	97	59	66	128	119	10.6%
Diode	62	95	124	78	88	94	63	86	131	119	7.5%
Small Signal Diode	18	27	37	47	51	28	12	16	17	16	-1.3%
Power Diode	32	54	66	26	32	57	38	55	80	76	10.1%
Zener Diode	12	14	21	5	5	9	13	15	34	27	9.4%
Thyristor	8	23	36	36	35	37	33	37	62	50	22.6%
Other Discrete	9	20	22	20	23	14	40	62	64	62	23.9%
Total Optoelectronic	28	42	56	92	130	114	112	125	129	120	17.6%
LED Lamps	7	15	18	28	43	39	33	36	31	33	18.8%
LED Displays	12	15	18	42	58	46	48	50	56	47	16.4%
Optical Couplers	3	3	8	6	8	6	8	10	12	12	16.7%
Other Optoelectronics	6	9	12	16	21	23	23	29	30	28	18.7%

Source: DATAQUEST
May 1986

TABLE 12

REST OF WORLD SEMICONDUCTOR CONSUMPTION FORECAST
(Millions of Dollars)
1984 through 1991, plus 1996

	1984	1985	1986	1987	1988	1989	1990	1991	CAGR (1985-91)	1996	CAGR (1991-96)
Total Semiconductor	2298	1897	2197	3017	3760	3683	4281	5158	18.1%	12676	19.7%
Total Integrated Circuit	1474	1155	1257	1843	2349	2273	2779	3477	20.2%	9590	22.5%
Bipolar Digital (Technology)	246	131	163	227	267	258	296	355	18.1%	745	16.0%
TTL											
ECL											
Other Bipolar Digital											
Bipolar Digital (Function)	246	131	163	227	267	258	296	355	18.1%	745	16.0%
Bipolar Digital Memory	7	6	7	9	10	9	10	12	12.2%	18	8.4%
Bipolar Digital Logic	239	125	156	218	257	249	286	343	18.3%	727	16.2%
MOS (Technology)	825	627	662	1073	1425	1348	1717	2249	23.7%	6906	25.2%
NMOS											
PMOS											
CMOS											
MOS (Function)	825	627	662	1073	1425	1348	1717	2249	23.7%	6906	25.2%
MOS Memory	313	136	195	449	611	544	686	905	37.1%	3091	27.8%
MOS Micro Device	164	135	162	228	315	310	409	548	26.3%	1484	22.0%
MOS Logic	348	356	305	396	499	494	622	796	14.4%	2331	24.0%
Linear	403	397	432	543	657	667	766	873	14.0%	1939	17.3%
Total Discrete	695	622	773	970	1174	1187	1222	1356	13.9%	2368	11.8%
Transistor	438	391	476	589	700	734	775	861	14.1%	1567	12.7%
Small Signal Transistor	310	272	332	434	475	506	509	565	13.0%	1050	13.2%
Power Transistor	128	119	144	155	225	228	266	296	16.4%	517	11.8%
Diode	131	119	148	190	243	234	234	259	13.8%	493	13.7%
Small Signal Diode	17	16	20	27	34	33	33	37	15.0%	68	12.9%
Power Diode	80	76	96	120	159	155	159	176	15.0%	351	14.8%
Zener Diode	34	27	32	43	50	46	42	46	9.3%	74	10.0%
Thyristor	62	50	65	85	105	93	82	91	10.5%	120	5.7%
Other Discrete	64	62	84	106	126	126	131	145	15.2%	188	5.3%
Total Optoelectronic	129	120	167	204	237	223	280	325	18.1%	718	17.2%
LED Lamps	31	33	44	49	56	51	68	79	15.7%	175	17.2%
LED Displays	56	47	65	87	101	92	113	131	18.6%	280	16.4%
Optical Couplers	12	12	18	23	27	28	35	41	22.7%	97	18.8%
Other Optoelectronics	30	28	38	45	53	52	64	74	17.6%	166	17.5%

Source: DATAQUEST
May 1986

TABLE 13

HISTORICAL WORLDWIDE AVERAGE SELLING PRICES
(Dollars)
1976 through 1985

	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	CAGR (76-85)
Total Semiconductor	0.29	0.28	0.29	0.30	0.32	0.31	0.33	0.33	0.36	0.35	2.1%
Total IC	1.00	1.02	1.01	0.97	1.07	1.02	1.01	1.04	1.11	1.06	0.7%
Bipolar Digital (Technology)	0.61	0.66	0.63	0.57	0.70	0.70	0.62	0.65	0.65	0.71	1.7%
TTL											
ECL											
Other Bipolar Digital											
Bipolar Digital (Function)	0.61	0.66	0.63	0.57	0.70	0.70	0.62	0.65	0.65	0.71	1.7%
Bipolar Digital Memory											
Bipolar Digital Logic											
MOS (Technology)	2.39	2.06	1.91	1.93	1.81	1.66	1.71	1.72	2.01	1.68	-3.8%
NMOS	4.71	4.46	4.46	3.66	3.08	3.06	2.91	3.15	3.68	2.55	-6.6%
PMOS	4.18	3.01	1.92	1.80	1.75	1.70	1.70	1.75	1.75	1.75	-9.2%
CMOS	0.73	0.76	0.64	0.78	0.79	0.74	0.78	0.80	0.99	1.07	4.4%
MOS (Function)	2.39	2.06	1.91	1.93	1.81	1.66	1.71	1.72	2.01	1.68	-3.8%
MOS Memory				5.15	4.90	3.17	3.06	3.21	3.83	2.53	
MOS Micro Device				3.96	3.61	3.40	3.34	3.40	4.41	3.85	
MOS Logic				0.89	0.85	0.86	0.80	0.79	0.85	0.93	
Linear	0.85	0.83	0.84	0.78	0.83	0.81	0.79	0.76	0.75	0.76	-1.2%
Total Discrete	0.15	0.14	0.13	0.12	0.12	0.11	0.11	0.09	0.09	0.09	-5.2%
Transistor	0.19	0.19	0.18	0.17	0.16	0.15	0.13	0.12	0.10	0.11	-6.5%
Small Signal Transistor	0.13	0.12	0.11	0.10	0.09	0.09	0.08	0.07	0.06	0.06	-8.2%
Power Transistor	0.73	0.78	0.73	0.70	0.68	0.56	0.54	0.49	0.41	0.39	-6.7%
Diode	0.09	0.08	0.08	0.07	0.07	0.07	0.07	0.06	0.06	0.06	-4.2%
Small Signal Diode	0.05	0.04	0.04	0.04	0.04	0.04	0.04	0.03	0.03	0.03	-5.5%
Power Diode	0.14	0.14	0.13	0.12	0.11	0.10	0.09	0.09	0.11	0.11	-2.6%
Zener Diode	0.15	0.15	0.18	0.11	0.14	0.14	0.13	0.12	0.11	0.11	-3.4%
Thyristor	0.89	0.92	0.91	0.89	0.98	1.09	0.95	0.92	0.68	0.67	-3.1%
Other Discrete	0.88	0.72	0.63	0.33	0.26	0.26	0.23	0.23	0.20	0.20	-15.2%
Total Optoelectronic	0.67	0.45	0.47	0.51	0.44	0.39	0.38	0.37	0.36	0.34	-7.3%
LED Lamps				0.18	0.13	0.12	0.12	0.12	0.11	0.10	
LED Displays				1.40	1.45	1.50	1.30	1.37	1.35	1.24	
Optical Couplers				0.79	0.83	0.77	0.70	0.66	0.62	0.54	
Other Optoelectronics				0.72	0.90	1.07	1.11	1.07	1.01	0.94	

Source: DATAQUEST
May 1986

TABLE 14

WORLDWIDE AVERAGE SELLING PRICES FORECAST
(Dollars)
1984 through 1991, plus 1996

	1984	1985	1986	1987	1988	1989	1990	1991	CAGR (1985-91)	1996	CAGR (1991-96)
Total Semiconductor	0.36	0.35	0.29	0.34	0.35	0.35	0.38	0.37	1.1%	0.51	6.6%
Total Integrated Circuit	1.11	1.06	1.07	1.17	1.27	1.27	1.34	1.42	5.0%	1.78	4.6%
Bipolar Digital (Technology)	0.65	0.71	0.71	0.75	0.80	0.81	0.85	0.86	3.2%	0.95	2.0%
TTL											
ECL											
Other Bipolar Digital											
Bipolar Digital (Function)	0.65	0.71	0.71	0.75	0.80	0.81	0.85	0.86	3.2%	0.95	2.0%
Bipolar Digital Memory											
Bipolar Digital Logic											
MOS (Technology)	2.01	1.68	1.78	1.95	2.11	2.07	2.18	2.32	5.5%	2.86	4.3%
NMOS	3.68	2.55	2.60	2.85	2.82	2.51	2.59	2.68	0.8%	2.43	-1.9%
PMOS	1.75	1.75	1.75	1.76	1.76	1.76	1.76	1.79	0.4%	1.84	0.6%
CMOS	0.99	1.07	1.26	1.49	1.78	1.89	2.05	2.24	13.1%	2.90	5.3%
MOS (Function)	2.01	1.68	1.78	1.95	2.11	2.07	2.18	2.32	5.5%	2.86	4.3%
MOS Memory	3.83	2.53	2.71	2.89	2.96	2.79	3.10	3.20	4.0%	3.15	-0.3%
MOS Micro Device	4.41	3.85	3.85	4.03	4.17	3.70	3.37	3.14	-3.3%	2.85	-1.9%
MOS Logic	0.85	0.93	0.99	1.05	1.14	1.22	1.32	1.50	8.3%	2.65	12.1%
Linear	0.75	0.76	0.72	0.72	0.74	0.75	0.75	0.76	0.0%	0.81	1.3%
Total Discrete	0.09	0.09	0.07	0.07	0.07	0.07	0.07	0.06	-7.4%	0.06	-0.1%
Transistor	0.10	0.11	0.09	0.09	0.07	0.07	0.07	0.06	-10.0%	0.06	-0.1%
Small Signal Transistor	0.06	0.06	0.05	0.05	0.04	0.04	0.04	0.03	-10.9%	0.03	0.0%
Power Transistor	0.41	0.39	0.39	0.38	0.36	0.36	0.34	0.34	-2.3%	0.31	-1.8%
Diode	0.06	0.06	0.05	0.04	0.04	0.05	0.04	0.05	-4.9%	0.05	0.1%
Small Signal Diode	0.03	0.03	0.02	0.02	0.02	0.02	0.02	0.02	-6.5%	0.02	0.0%
Power Diode	0.11	0.11	0.09	0.08	0.08	0.08	0.08	0.08	-5.2%	0.07	-2.6%
Zener Diode	0.11	0.11	0.11	0.10	0.10	0.10	0.10	0.11	0.0%	0.11	0.0%
Thyristor	0.68	0.67	0.68	0.67	0.67	0.67	0.66	0.66	-0.3%	0.66	0.0%
Other Discrete	0.20	0.20	0.19	0.19	0.18	0.18	0.17	0.17	-2.7%	0.15	-2.5%
Total Optoelectronic	0.36	0.34	0.35	0.36	0.34	0.35	0.34	0.31	-1.1%	0.32	0.3%
LED Lamps	0.11	0.10	0.10	0.10	0.09	0.09	0.09	0.08	-3.7%	0.08	0.0%
LED Displays	1.35	1.24	1.30	1.30	1.29	1.29	1.28	1.28	0.5%	1.24	-0.6%
Optical Couplers	0.62	0.54	0.62	0.62	0.61	0.61	0.61	0.60	1.8%	0.59	-0.3%
Other Optoelectronics	1.01	0.94	1.00	1.00	0.99	0.99	0.99	0.99	0.9%	0.98	-0.2%

Source: DATAQUEST
May 1986

TABLE 15

HISTORICAL WORLDWIDE SEMICONDUCTOR CONSUMPTION
(Millions of Units)
1976 through 1985

	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	CAGR (76-85)
Total Semiconductor	20823	25653	30986	37421	43800	47180	46264	60344	79853	71565	14.7%
Total IC	3093	3703	5171	7242	8955	9809	10791	14110	20455	17734	21.4%
Bipolar Digital (Technology)	1418	1506	2002	2937	3391	3339	3890	4612	7403	5330	15.8%
TTL											
ECL											
Other Bipolar Digital											
Bipolar Digital (Function)	1418	1506	2002	2937	3391	3339	3890	4612	7403	5330	15.8%
Bipolar Digital Memory											
Bipolar Digital Logic											
MOS (Technology)	518	769	1221	1731	2603	2906	3306	4665	6482	6132	31.6%
NMOS	80	147	305	597	1041	1042	1341	1745	2405	2508	46.6%
PMOS	157	204	299	276	287	265	221	182	161	83	-6.8%
CMOS	281	418	617	858	1275	1598	1744	2738	3917	3540	32.5%
MOS (Function)	518	769	1221	1731	2603	2906	3306	4665	6482	6132	31.6%
MOS Memory				325	455	655	883	1150	1635	1584	
MOS Micro Device				137	239	319	395	592	739	715	
MOS Logic				1269	1909	1933	2029	2923	4108	3833	
Linear	1156	1428	1949	2574	2960	3564	3595	4833	6569	6272	20.7%
Total Discrete	17308	20679	24917	29068	33288	35326	33314	43443	55882	50318	12.6%
Transistor	6940	7513	9113	10060	11750	13826	13464	16314	24448	21486	13.4%
Small Signal Transistor	6192	6667	8109	8910	10422	12178	11913	14400	21417	18483	12.9%
Power Transistor	748	846	1004	1150	1328	1648	1552	1914	3032	3003	16.7%
Diode	9956	12643	15189	18040	20360	20431	18683	25731	29309	26518	11.5%
Small Signal Diode	5620	7775	9250	10925	11950	11350	9825	15300	17900	16200	12.5%
Power Diode	3543	4021	5100	5733	7145	7710	7389	8822	9018	8109	9.6%
Zener Diode	793	847	839	1382	1264	1371	1469	1608	2391	2209	12.1%
Thyristor	272	326	373	410	409	327	332	341	644	664	10.4%
Other Discrete	140	197	243	558	769	742	835	1057	1480	1650	31.6%
Total Optoelectronic	422	671	898	1111	1557	2045	2159	2791	3516	3513	26.5%
LED Lamps				661	1046	1500	1558	2042	2518	2490	ERR
LED Displays				167	185	190	220	265	336	340	ERR
Optical Couplers				101	120	158	184	230	305	320	ERR
Other Optoelectronics				182	206	196	196	254	357	363	ERR

Source: DATAQUEST
May 1986

TABLE 16

WORLDWIDE SEMICONDUCTOR CONSUMPTION FORECAST
(Millions of Units)
1984 through 1991, plus 1996

	1984	1985	1986	1987	1988	1989	1990	1991	CAGR (1985-91)	1996	CAGR (1991-96)
Total Semiconductor	79853	71565	96888	113336	135286	131909	146067	183803	17.0%	299324	10.2%
Total Integrated Circuit	20455	17734	20483	26112	30542	29827	34314	40198	14.6%	75677	13.5%
Bipolar Digital (Technology)	7403	5330	5752	6812	7514	7095	7592	8748	8.6%	14951	11.3%
TTL											
ECL											
Other Bipolar Digital											
Bipolar Digital (Function)	7403	5330	5752	6812	7514	7095	7592	8748	8.6%	14951	11.3%
Bipolar Digital Memory											
Bipolar Digital Logic											
MOS (Technology)	6482	6132	6849	9325	11389	11432	13671	16526	18.0%	34902	16.1%
NMOS	2405	2508	2624	3155	3640	3266	3435	3189	4.1%	2672	-3.5%
PMOS	161	83	66	60	49	41	38	34	-13.9%	30	-2.5%
CMOS	3917	3540	4159	6109	7700	8125	10198	13303	24.7%	32200	19.3%
MOS (Function)	6482	6132	6849	9325	11389	11432	13671	16526	18.0%	34902	16.1%
MOS Memory	1635	1584	1691	2543	3390	3203	3577	4392	18.5%	10502	19.0%
MOS Micro Device	739	715	871	1254	1615	1875	2660	3746	31.8%	10938	23.9%
MOS Logic	4108	3833	4287	5528	6385	6354	7433	8388	13.9%	13462	9.9%
Linear	6569	6272	7882	9975	11639	11300	13052	14925	15.5%	25825	11.6%
Total Discrete	55882	50318	74131	82347	98679	96361	104945	134877	17.9%	206369	8.9%
Transistor	24448	21486	29609	32978	44067	45364	49687	73522	22.8%	121167	10.5%
Small Signal Transistor	21417	18483	26260	29160	39350	40600	44125	67233	24.0%	109767	10.3%
Power Transistor	3032	3003	3349	3818	4717	4764	5562	6288	13.1%	11400	12.6%
Diode	29309	26518	41850	46438	51103	47625	51378	56852	13.6%	77552	6.4%
Small Signal Diode	17900	16200	27250	28350	31300	28600	31100	34450	13.4%	41300	3.7%
Power Diode	9018	8109	12100	15188	16413	15775	17088	19375	15.6%	32143	10.7%
Zener Diode	2391	2209	2500	2900	3390	3250	3190	3027	5.4%	4109	6.3%
Thyristor	644	664	746	804	904	800	786	821	3.6%	977	3.5%
Other Discrete	1480	1650	1926	2126	2606	2572	3094	3682	14.3%	6673	12.6%
Total Optoelectronic	3516	3513	4274	4878	6064	5721	6808	8728	16.4%	17278	14.6%
LED Lamps	2518	2490	3090	3460	4356	4000	4811	6363	16.9%	12350	14.2%
LED Displays	336	340	392	448	524	498	576	661	11.7%	1215	13.0%
Optical Couplers	305	320	352	413	500	530	621	752	15.3%	1597	16.3%
Other Optoelectronics	357	363	441	557	685	694	800	953	17.5%	2116	17.3%

Source: DATAQUEST
May 1986

TABLE 17

HISTORICAL WORLDWIDE SEMICONDUCTOR FACTORY SHIPMENTS
(Millions of Dollars)
1976 through 1985

	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	CAGR (76-85)
Total Semiconductor	5982	6968	8953	11114	14118	14828	15261	19665	29087	24735	17.1%
Total IC	3087	3763	5230	7028	9546	10046	10894	14684	22753	18875	22.3%
Bipolar Digital (Technology)	865	994	1261	1674	2374	2337	2412	2998	4812	3784	17.8%
TTL	682	771	990	1365	1930	1823	1889	2423	4067	3043	18.1%
ECL	76	95	138	170	300	376	391	445	607	607	26.0%
Other Bipolar Digital	107	128	133	139	144	138	132	130	138	134	2.5%
Bipolar Digital (Function)	865	994	1261	1674	2374	2337	2412	2998	4812	3784	17.8%
Bipolar Digital Memory				324	572	558	511	593	719	595	
Bipolar Digital Logic				1350	1802	1779	1901	2405	4093	3189	
MOS (Technology)	1239	1584	2332	3346	4715	4822	5642	8013	13014	10324	26.6%
NMOS	377	655	1361	2184	3207	3190	3902	5496	8850	6390	37.0%
PMOS	658	613	574	497	503	451	376	319	281	146	-15.4%
CMOS	204	316	397	665	1005	1181	1364	2198	3883	3788	38.3%
MOS (Function)	1239	1584	2332	3346	4715	4822	5642	8013	13014	10324	26.6%
MOS Memory				1676	2230	2075	2701	3691	6261	4008	
MOS Micro Device				541	862	1005	1318	2013	3261	2751	
MOS Logic				1129	1623	1662	1623	2309	3492	3565	
Linear	983	1185	1637	2008	2457	2887	2840	3673	4927	4767	19.2%
Total Discrete	2612	2983	3301	3522	3883	3985	3547	3949	5054	4676	6.7%
Transistor	1351	1460	1625	1696	1841	2019	1791	1946	2528	2280	6.0%
Small Signal Transistor	805	800	892	891	938	1096	953	1008	1285	1109	3.6%
Power Transistor	546	660	733	805	903	923	838	938	1243	1171	8.8%
Diode	896	1001	1184	1277	1441	1417	1249	1446	1792	1621	6.8%
Small Signal Diode	281	311	370	437	478	454	393	459	537	486	6.3%
Power Diode	496	563	663	688	786	771	665	794	992	892	6.7%
Zener Diode	119	127	151	152	177	192	191	193	263	243	8.3%
Thyristor	242	300	339	365	401	356	315	314	438	445	7.0%
Other Discrete	123	142	153	184	200	193	192	243	296	330	11.6%
Total Optoelectronic	283	302	422	564	689	797	820	1032	1280	1184	17.2%
LED Lamps	53	73	101	119	136	180	187	245	277	249	18.8%
LED Displays	148	139	187	234	268	285	286	363	453	421	12.3%
Optical Couplers	29	34	52	80	100	122	129	152	189	173	22.0%
Other Optoelectronics	53	56	82	131	185	210	218	272	361	341	23.0%

Source: DATAQUEST
May 1986

Historical Factory Shipments

TABLE 18
HISTORICAL NORTH AMERICAN SEMICONDUCTOR FACTORY SHIPMENTS
(Millions of Dollars)
1976 through 1985

FACTORY SHIPMENTS WERE NOT AVAILABLE AT TIME OF PUBLICATION. THIS SECTION WILL BE SUPPLIED AT A LATER DATE.

Historical Factory Shipments

TABLE 19
HISTORICAL JAPANESE SEMICONDUCTOR FACTORY SHIPMENTS
(Millions of Dollars)
1976 through 1985

FACTORY SHIPMENTS WERE NOT AVAILABLE AT TIME OF PUBLICATION. THIS SECTION WILL BE SUPPLIED AT A LATER DATE.

Historical Factory Shipments

TABLE 20
HISTORICAL JAPANESE SEMICONDUCTOR FACTORY SHIPMENTS
(Billions of Yen)
1976 through 1985

FACTORY SHIPMENTS WERE NOT AVAILABLE AT TIME OF PUBLICATION. THIS SECTION WILL BE SUPPLIED AT A LATER DATE.

Historical Factory Shipments

TABLE 21
HISTORICAL EUROPEAN SEMICONDUCTOR FACTORY SHIPMENTS
(Millions of Dollars)
1976 through 1985

FACTORY SHIPMENTS WERE NOT AVAILABLE AT TIME OF PUBLICATION. THIS SECTION WILL BE SUPPLIED AT A LATER DATE.

Historical Factory Shipments

TABLE 22
HISTORICAL REST OF WORLD SEMICONDUCTOR FACTORY SHIPMENTS
(Millions of Dollars)
1976 through 1985

FACTORY SHIPMENTS WERE NOT AVAILABLE AT TIME OF PUBLICATION. THIS SECTION WILL BE SUPPLIED AT A LATER DATE.

Consumption and Factory Shipments

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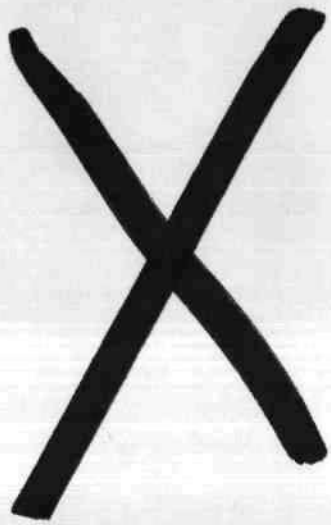


Semiconductor Consumption

INTRODUCTION

Semiconductor consumption data comprise a set of detailed tables that estimate the size of the semiconductor market worldwide and for four major geographical regions for the years 1978 through 1992 and 1997. Semiconductor consumption tables contain both historical data and forecasts. Historical data begin with 1978 and end with 1986, while forecast data provide annual market size estimates for 1987 through 1992, with additional estimates for 1997. Below is a list of tables detailing the type of data, region, time period, and units of measure.

LIST OF TABLES

Table	Region Covered	Years	Units
0	Japan and Western Europe Exchange Rates	1970-1986	Various
1a	Worldwide Consumption	1978-1983	Dollars
1b	Worldwide Consumption	1984-1989	Dollars
1c	Worldwide Consumption	1990-1992; 1997	Dollars
2a	North American Consumption	1978-1983	Dollars
2b	North American Consumption	1984-1989	Dollars
2c	North American Consumption	1990-1992; 1997	Dollars
3a	Japanese Consumption	1978-1983	Dollars
3b	Japanese Consumption	1984-1989	Dollars
3c	Japanese Consumption	1990-1992; 1997	Dollars
4a	Japanese Consumption	1978-1983	Yen
4b	Japanese Consumption	1984-1989	Yen
4c	Japanese Consumption	1990-1992; 1997	Yen
5a	Western European Consumption	1978-1983	Dollars
5b	Western European Consumption	1984-1989	Dollars
5c	Western European Consumption	1990-1992; 1997	Dollars
6a	Rest of World Consumption	1978-1983	Dollars
6b	Rest of World Consumption	1984-1989	Dollars
6c	Rest of World Consumption	1990-1992; 1997	Dollars
7a	Worldwide Average Selling Prices	1978-1983	Dollars
7b	Worldwide Average Selling Prices	1984-1989	Dollars
7c	Worldwide Average Selling Prices	1990-1992; 1997	Dollars
8a	Worldwide Consumption	1978-1983	Units
8b	Worldwide Consumption	1984-1989	Units
8c	Worldwide Consumption	1990-1992; 1997	Units

Semiconductor Consumption

Each table gives estimates of semiconductor consumption listed by the major semiconductor device product categories. In these tables, semiconductor components are divided into three major product groups: integrated circuits, discrete devices, and optoelectronic devices. These groups are divided into a number of subgroups, some of which are segmented further.

DEFINITIONS AND CONVENTIONS

Dataquest uses a common manufacturer base for all data tables. This base includes all suppliers to the merchant semiconductor market. It excludes captive suppliers that manufacture devices solely for the benefit of the parent company, such as AT&T, Burroughs, Delco, and IBM. Included, however, are companies that actively market semiconductor devices to the merchant market as well as to other divisions of their own companies. For such companies, both external shipments and internal consumption are included. Devices that are used internally are valued at current market prices.

Consumption—Dataquest defines consumption as the purchase of a semiconductor device or devices. This definition must be differentiated from actual use of the device in a final product. Devices that are inventoried at the user level are considered consumption according to our definition. The terms consumption and market size are used interchangeably. Thus, a regional market includes all devices sold to or shipped to that region.

Hybrids—In earlier consumption data, hybrid devices were included as a separate segment of integrated circuits. However, since hybrid devices are primarily a special packaging arrangement, this segment has been omitted. Hybrid devices manufactured by semiconductor companies are now included in the most appropriate product segment, usually the linear segment.

Power Devices—The difference between low-power and high-power transistors is set at the 1-watt power-handling capability. Power diodes are rated at 1 amp or higher; small-signal diodes are rated at less than 1 amp. Special discrete devices that are neither transistors, diodes, nor thyristors are categorized as "other discretes."

The manufacturer base product group definitions and guidelines for including value of output that we have used in our tables may differ from those used in other studies of this type. Our base is nearly the same as that used by the World Semiconductor Trade Statistics program (WSTS).

Semiconductor Consumption

Regions—North America is defined as including both the United States and Canada. Latin America, including Mexico, is considered part of the Rest of World (ROW) category. Western Europe includes Austria, Belgium, the Federal Republic of Germany, France, Greece, Italy, Luxembourg, the Scandinavian countries (Denmark, Finland, Norway, Sweden), Spain, and the United Kingdom.

DATA SOURCES

The information presented in the consumption data has been consolidated from a variety of sources, each of which focuses on a specific part of the market. These sources include the following:

- World Semiconductor Trade Statistics (WSTS) data, and Dataquest's estimates of regional company sales are used to determine North American consumption.
- Japanese trade statistics compiled and published by the Ministry of Finance (MOF) and the Ministry of International Trade and Industry (MITI), WSTS data, and Dataquest's estimates of regional company sales are used to determine Japanese consumption.
- For Western European markets, marketing statistics from WSTS data and Dataquest's estimates of regional company sales are used to determine consumption.
- In ROW, the major published sources used to estimate consumption are WSTS data and Dataquest's estimates of company shipments into the region.

Dataquest believes that the estimates presented here are the most accurate and meaningful generally available today. The sources of the data and the guidelines for the forecasts presented in the tables are:

- Unit sales or revenue (or both) published by major industry participants, both in the United States and abroad
- Estimates presented by knowledgeable and reliable industry spokesmen
- Government data or trade association data such as those from the Electronics Industry Association (EIA), MITI, WSTS, and the U.S. Department of Commerce

- Published product literature and price lists
- Interviews with knowledgeable manufacturers, distributors, and users
- Relevant projected world economic data

CONSISTENCY

One of the key objectives in preparing these estimates is to achieve consistency among the various data elements that constitute the forecast and the historical data base. To ensure the accuracy and consistency of the estimates, we have compared the values of directly obtained data elements with values obtained by indirect means, wherever possible. Thus, the worldwide totals in the consumption analysis are consistent with the worldwide totals of the market share analysis.

ACCURACY

The tables presented here represent Dataquest estimates that we believe are reasonably accurate. Where we have no reasonable estimate, none is given. A blank space in a table indicates that a reasonably accurate estimate is unavailable, and a zero in a table represents an estimate.

VALUATION OF CONSUMPTION

Regional consumption is expressed in U.S. dollars (with Japanese consumption and shipments also expressed in yen). To make the tables in this study useful in comparing different regions, it is necessary to express all values in a common currency, and we chose the U.S. dollar for convenience.

However, the choice of the U.S. dollar (or any single currency, for that matter) as the currency basis for the tables brings with it some problems that require the readers' careful consideration in interpreting the data.

Inflation

All countries that participate significantly in international semiconductor markets suffered from an overall price inflation in the 1970s, continuing into the 1980s.

As a consequence, the dollar in a given year is not truly comparable with the dollar in any preceding year. Consumer and wholesale price indices and GNP deflators all measure price changes in various composite "market baskets" of goods. However, there is no price index that measures price changes of material, equipment, and labor inputs to the semiconductor industry. Indeed, the "mix" is changing so rapidly that what is used this year was sometimes unavailable last year, at any price. Nor is there a composite price index that measures price changes in aggregate semiconductor product. In an industry noted for its deflationary trends, this latter effect would tend to make the component purchaser's dollar worth more as time passed, in terms of purchasing ability.

We have made no adjustments in the historical data to account for these inflationary and deflationary effects. The data are expressed in current dollars (dollars that include the inflation rate and exchange rates of the given year) for all historical data; comparisons between different years must be interpreted accordingly.

Average Selling Prices

When considering the worldwide average selling prices (ASPs) for semiconductor components, one must look at the price per function of a circuit, the complexity of the circuit, and the product mix according to this increasing complexity. It is true that one characteristic of the semiconductor industry is that the price per function for integrated circuits has been dropping an average of 30 percent per year for the last 15 years. At the same time, circuits have become denser, resulting in an overall increase in the price of a device with a decreasing cost per function. Thus, Table 7 shows the worldwide ASPs increasing after many years of decreasing, due to the move toward higher-complexity devices. There are also regional differences in ASPs due to regional competition differences and the varying regional product consumption mix. The worldwide ASP is truly an aggregate measure and may differ significantly from ASPs in any specific market at any point in time.

Exchange Rates

Construction of the West European tables involves combining data from many countries, each of which has different and changing exchange rates. Dataquest uses Annual Foreign Exchange Rates for each year as published by The International Monetary Fund. As far as possible, we prepare our estimates in terms of local currencies before conversion to U.S. dollars. The exchange rates for major currencies can be found in Table 0 at the end of this introduction.

Semiconductor Consumption

Japanese consumption is based on MITI data, originally expressed in yen. The Japanese data published in this study are expressed in both dollars (Tables 3a, 3b, and 3c) and in yen (Tables 4a, 4b, and 4c). The yen/dollar exchange rate used for each year can be found in Table 0. Because of the fluctuations in the exchange rate for the yen, the dollar values given tend to distort the growth rate of the Japanese market, but they do provide a useful basis for regional market size comparisons. However, the data in yen give a better picture of the real growth in the Japanese market.

FORECAST

As mentioned previously, historical data are expressed in current dollars or dollars that include the given year's inflation rate and exchange rates. However, the consumption forecasts use constant dollars and exchange rates, with no allowance for inflation or variations in the rates of exchange between countries. All estimates for 1987 and beyond are made as if 1987 monetary conditions will continue through 1997 and, therefore, show the absolute year-to-year growth during this period.

Table 0

Foreign Exchange Rates
(In U.S. Dollars)

Year	Yrly/ Qtrly	Japan (Yen per US$)	France (US$ per Franc)	West Germany (US$ per Deutsche Mark)	United Kingdom (US$ per Pound Sterling)	European Basket ECU (1980 = 100)
1970	YR	¥358	$0.1808	$0.2740	$2.3810	
1971	YR	¥343	$0.1815	$0.2874	$2.4390	
1972	YR	¥302	$0.1984	$0.3135	$2.5000	
1973	YR	¥269	$0.2247	$0.3745	$2.4390	
1974	YR	¥292	$0.2079	$0.3861	$2.3256	
1975	YR	¥297	$0.2331	$0.4065	$2.2222	
1976	YR	¥296	$0.2092	$0.3968	$1.8182	
1977	YR	¥266	$0.2037	$0.4310	$1.7544	
1978	YR	¥206	$0.2217	$0.4975	$1.9231	
1979	YR	¥221	$0.2353	$0.5464	$2.1277	
1980	YR	¥225	$0.2364	$0.5495	$2.3256	$100.0
1981	YR	¥221	$0.1842	$0.4425	$1.0408	$123.7
1982	YR	¥249	$0.1522	$0.4115	$1.7544	$141.3
1983	YR	¥238	$0.1312	$0.3922	$1.4085	$157.6
1984	YR	¥237	$0.1144	$0.3509	$1.3333	$178.1
1985	YR	¥238	$0.1144	$0.3401	$1.2821	$184.7
1986	YR	¥167	$0.1443	$0.4608	$1.4706	$145.9
1987	Q1	¥153	$0.1608	$0.5376	$1.5152	$129.9
1987	Q2	¥142				$125.6
1987	Q3	¥142				$126.8

Source: The International Monetary Fund
Dataquest
December 1987

Semiconductor Consumption

Table 1a

Worldwide Semiconductor Consumption
(Millions of Dollars)

	1978	1979	1980	1981	1982	1983
Total Semiconductor	$8,953	$11,114	$14,118	$14,828	$15,261	$19,665
Total IC	$5,230	$ 7,028	$ 9,546	$10,046	$10,894	$14,684
Bipolar Digital (Tech)	$1,261	$1,674	$ 2,374	$ 2,337	$ 2,412	$ 2,998
TTL	990	1,365	1,930	1,823	1,889	2,374
ECL	138	170	300	376	391	478
Other	133	139	144	138	132	146
Bipolar Digital (Func)	$1,261	$ 1,674	$ 2,374	$ 2,337	$ 2,412	$ 2,998
Memory		324	572	558	511	593
Logic		1,350	1,802	1,779	1,901	2,405
MOS (Technology)	$2,332	$ 3,346	$ 4,715	$ 4,822	$ 5,642	$ 8,013
NMOS	1,361	2,184	3,207	3,190	3,929	5,523
PMOS	574	497	503	451	376	319
CMOS	397	665	1,005	1,181	1,337	2,171
MOS (Function)	$2,332	$ 3,346	$ 4,715	$ 4,822	$ 5,642	$ 8,013
Memory		1,676	2,230	2,075	2,701	3,691
Micro Device		541	862	1,085	1,318	2,013
Logic		1,129	1,623	1,662	1,623	2,309
Linear	$1,637	$ 2,008	$ 2,457	$ 2,887	$ 2,840	$ 3,673
Total Discrete	$3,301	$ 3,522	$ 3,883	$ 3,985	$ 3,547	$ 3,949
Total Optoelectronic	$ 422	$ 564	$ 689	$ 797	$ 820	$ 1,032

Source: Dataquest
December 1987

Semiconductor Consumption

Table 1b

Worldwide Semiconductor Consumption
(Millions of Dollars)

	1984	1985	1986	1987	1988	1989
Total Semiconductor	$29,087	$24,823	$31,009	$38,430	$47,542	$47,364
Total IC	$22,753	$18,988	$23,601	$29,833	$37,319	$37,441
Bipolar Digital (Tech)	$ 4,812	$ 3,799	$ 4,321	$ 5,161	$ 6,257	$ 6,155
TTL	4,075	2,971	3,221			
ECL	563	597	751			
Other	174	231	349			
Bipolar Digital (Func)	$ 4,812	$ 3,799	$ 4,321	$ 5,161	$ 6,257	$ 6,155
Memory	719	603	675	750	860	829
Logic	4,093	3,196	3,646	4,411	5,397	5,326
MOS (Technology)	$13,014	$10,422	$13,064	$17,300	$22,471	$22,638
NMOS	8,888	6,392	7,412	8,549	9,355	7,176
PMOS	281	146	112	101	83	68
CMOS	3,845	3,884	5,540	8,650	13,033	15,394
MOS (Function)	$13,014	$10,422	$13,064	$17,300	$22,471	$22,638
Memory	6,261	4,013	4,338	5,526	7,218	7,201
Micro Device	3,261	2,751	3,661	4,850	6,270	6,201
Logic	3,492	3,658	5,065	6,924	8,983	9,236
Linear	$ 4,927	$ 4,767	$ 6,216	$ 7,372	$ 8,591	$ 8,648
Total Discrete	$ 5,054	$ 4,670	$ 5,818	$ 6,763	$ 7,991	$ 7,830
Total Optoelectronic	$ 1,280	$ 1,165	$ 1,590	$ 1,834	$ 2,232	$ 2,093

Source: Dataquest
December 1987

Semiconductor Consumption

Table 1c

Worldwide Semiconductor Consumption
(Millions of Dollars)

	1990	1991	1992	CAGR (87-92)	1997	CAGR (92-97)
Total Semiconductor	$53,816	$63,122	$75,734	14.5%	$132,119	11.8%
Total IC	$43,117	$51,256	$62,514	15.9%	$115,567	13.1%
Bipolar Digital (Tech)	$ 6,903	$ 7,951	$ 9,404	12.7%	$ 14,635	9.2%
TTL						
ECL						
Other						
Bipolar Digital (Func)	$ 6,903	$ 7,951	$ 9,404	$ 12.7%	$ 14,635	9.2%
Memory	860	930	1,023	6.4%	1,461	7.4%
Logic	6,043	7,021	8,381	13.7%	13,174	9.5%
MOS (Technology)	$26,607	$32,487	$40,925	18.8%	$ 85,662	15.9%
NMOS	5,791	4,491	4,043	(13.9%)	856	(26.7%)
PMOS	63	57	50	(13.1%)	1	(54.3%)
CMOS	20,753	27,939	36,833	33.6%	84,805	18.2%
MOS (Function)	$26,607	$32,487	$40,925	18.8%	$ 85,662	15.9%
Memory	8,261	9,881	12,615	17.9%	24,400	14.1%
Micro Device	7,428	9,336	12,029	19.9%	26,662	17.3%
Logic	10,918	13,270	16,281	18.6%	34,600	16.3%
Linear	$ 9,607	$10,818	$12,185	10.6%	$ 15,270	4.6%
Total Discrete	$ 8,395	$ 9,281	$10,256	6.7%	$ 11,763	5.6%
Total Optoelectronic	$ 2,304	$ 2,585	$ 2,964	10.1%	$ 4,789	10.1%

Source: Dataquest
December 1987

Semiconductor Consumption

Table 2b

North American Semiconductor Consumption
(Millions of Dollars)

	1984	1985	1986	1987	1988	1989
Total Semiconductor	$13,139	$9,607	$10,201	$12,344	$15,186	$14,924
Total IC	$10,940	$7,710	$ 8,136	$10,123	$12,664	$12,488
Bipolar Digital (Tech)	$ 2,843	$2,006	$ 2,021	$ 2,311	$ 2,752	$ 2,752
TTL						
ECL						
Other						
Bipolar Digital (Func)	$ 2,843	$2,006	$ 2,021	$ 2,311	$ 2,752	$ 2,752
Memory	431	315	335	370	415	400
Logic	2,412	1,691	1,686	1,941	2,337	2,352
MOS (Technology)	$ 6,355	$4,247	$ 4,484	$ 6,055	$ 7,827	$ 7,643
NMOS						
PMOS						
CMOS						
MOS (Function)	$ 6,355	$4,247	$ 4,484	$ 6,055	$ 7,827	$ 7,643
Memory	3,248	1,774	1,560	2,049	2,686	2,486
Micro Device	1,719	1,195	1,262	1,686	2,229	2,141
Logic	1,388	1,278	1,662	2,320	2,912	3,016
Linear	$ 1,742	$1,457	$ 1,631	$ 1,757	$ 2,085	$ 2,093
Total Discrete	$ 1,727	$1,528	$ 1,649	$ 1,758	$ 1,970	$ 1,981
Total Optoelectronic	$ 472	$ 369	$ 416	$ 463	$ 552	$ 455

Source: Dataquest
December 1987

Semiconductor Consumption

Table 2c

North American Semiconductor Consumption
(Millions of Dollars)

	1990	1991	1992	CAGR (87-92)	1997	CAGR (92-97)
Total Semiconductor	$16,811	$19,229	$22,595	12.9%	$37,770	10.8%
Total IC	$14,258	$16,467	$19,576	14.1%	$33,850	11.6%
Bipolar Digital (Tech)	$ 3,071	$ 3,537	$ 4,196	12.7%	$ 6,850	10.3%
TTL						
ECL						
Other						
Bipolar Digital (Func)	$ 3,071	$ 3,537	$ 4,196	12.7%	$ 6,850	10.3%
Memory	416	455	510	6.6%	850	10.8%
Logic	2,655	3,082	3,686	13.7%	6,000	10.2%
MOS (Technology)	$ 8,766	$10,266	$12,350	15.3%	$22,900	13.1%
NMOS						
PMOS						
CMOS						
MOS (Function)	$ 8,766	$10,266	$12,350	15.3%	$22,900	13.1%
Memory	2,729	3,097	3,620	12.1%	6,000	10.6%
Micro Device	2,516	2,972	3,660	16.8%	7,000	13.8%
Logic	3,521	4,197	5,070	16.9%	9,900	14.3%
Linear	$ 2,421	$ 2,664	$ 3,030	11.5%	$ 4,100	6.2%
Total Discrete	$ 2,073	$ 2,240	$ 2,450	5.8%	$ 3,000	4.9%
Total Optoelectronic	$ 480	$ 522	$ 569	8.2%	$ 920	6.9%

Source: Dataquest
December 1987

Semiconductor Consumption

Table 3b

Japanese Semiconductor Consumption
(Millions of Dollars)

	1984	1985	1986	1987	1988	1989
Total Semiconductor	$8,845	$8,599	$12,356	$14,395	$17,347	$17,290
Total IC	$6,705	$6,567	$ 9,490	$11,197	$13,576	$13,586
Bipolar Digital (Tech)	$ 999	$ 953	$ 1,298	$ 1,442	$ 1,761	$ 1,724
TTL						
ECL						
Other						
Bipolar Digital (Func)	$ 999	$ 953	$ 1,298	$ 1,442	$ 1,761	$ 1,724
Memory	132	125	156	180	210	204
Logic	867	828	1,142	1,262	1,551	1,520
MOS (Technology)	$3,742	$3,595	$ 5,216	$ 6,391	$ 7,991	$ 8,011
NMOS						
PMOS						
CMOS						
MOS (Function)	$3,742	$3,595	$ 5,216	$ 6,391	$ 7,991	$ 8,011
Memory	1,705	1,353	1,729	2,030	2,593	2,715
Micro Device	913	936	1,541	1,981	2,399	2,327
Logic	1,124	1,306	1,946	2,380	2,999	2,969
Linear	$1,964	$2,019	$ 2,976	$ 3,364	$ 3,824	$ 3,851
Total Discrete	$1,669	$1,566	$ 2,150	$ 2,376	$ 2,764	$ 2,717
Total Optoelectronic	$ 471	$ 466	$ 716	$ 822	$ 1,007	$ 987

Source: Dataquest
December 1987

Semiconductor Consumption

Table 3c

Japanese Semiconductor Consumption
(Millions of Dollars)

	1990	1991	1992	CAGR (87-92)	1997	CAGR (92-97)
Total Semiconductor	$19,514	$22,816	$27,335	13.7%	$51,046	13.3%
Total IC	$15,484	$18,284	$22,287	14.8%	$43,964	14.6%
Bipolar Digital (Tech)	$ 1,927	$ 2,200	$ 2,568	12.2%	$ 4,332	11.0%
TTL						
ECL						
Other						
Bipolar Digital (Func)	$ 1,927	$ 2,200	$ 2,568	12.2%	$ 4,332	11.0%
Memory	209	224	236	5.6%	283	3.7%
Logic	1,718	1,976	2,332	13.1%	4,049	11.7%
MOS (Technology)	$ 9,413	$11,492	$14,723	18.2%	$33,762	18.1%
NMOS						
PMOS						
CMOS						
MOS (Function)	$ 9,413	$11,492	$14,723	18.2%	$33,762	18.1%
Memory	3,147	3,770	5,105	20.3%	10,500	15.5%
Micro Device	2,792	3,518	4,573	18.2%	11,262	19.8%
Logic	3,474	4,204	5,045	16.2%	12,000	18.9%
Linear	$ 4,144	$ 4,592	$ 4,996	8.2%	$ 5,870	3.3%
Total Discrete	$ 2,918	$ 3,254	$ 3,553	7.3%	$ 4,463	6.0%
Total Optoelectronic	$ 1,112	$ 1,278	$ 1,495	12.3%	$ 2,619	14.0%

Source: Dataquest
December 1987

Semiconductor Consumption

Table 4a

Japanese Semiconductor Consumption
(Billions of Yen)

	1978	1979	1980	1981	1982	1983
Total Semiconductor	¥514.1	¥606.2	¥768.1	¥949.1	¥1,012.3	¥1,328.0
Total IC	¥293.8	¥380.7	¥499.7	¥617.3	¥ 708.0	¥ 940.5
Bipolar Digital (Tech)	¥ 54.4	¥ 66.6	¥ 78.3	¥ 96.8	¥ 123.5	¥ 146.7
TTL	20.8	28.5	33.6	41.5	53.3	65.6
ECL	16.4	25.6	30.2	37.3	45.6	51.0
Other	17.2	12.5	14.5	18.0	24.6	30.1
Bipolar Digital (Func)	¥ 54.4	¥ 66.6	¥ 78.3	¥ 96.8	¥ 123.5	¥ 146.7
Memory		11.4	12.9	17.0	21.6	13.9
Logic		55.2	65.4	79.8	101.9	132.8
MOS (Tech)	¥123.5	¥166.9	¥225.0	¥259.5	¥ 313.2	¥ 451.2
NMOS	77.1	107.1	151.0	173.9	207.3	303.4
PMOS	35.9	23.9	19.5	16.9	14.1	13.6
CMOS	10.5	35.9	54.5	68.7	91.8	134.2
MOS (Func)	¥123.5	¥166.9	¥225.0	¥259.5	¥ 313.2	¥ 451.2
Memory		56.1	96.0	108.5	132.4	203.3
Micro Device		46.6	61.1	89.3	110.6	139.6
Logic		64.2	67.9	61.7	70.2	108.3
Linear	¥115.9	¥147.2	¥196.4	¥261.0	¥ 271.3	¥ 342.6
Total Discrete	¥198.6	¥194.7	¥223.8	¥273.3	¥ 240.5	¥ 297.8
Total Optoelectronic	¥ 21.7	¥ 30.8	¥ 44.6	¥ 58.5	¥ 63.8	¥ 89.7

Source: Dataquest
December 1987

Semiconductor Consumption

Table 4b

Japanese Semiconductor Consumption
(Billions of Yen)

	1984	1985	1986	1987	1988	1989
Total Semiconductor	¥2,096.3	¥2,049.0	¥2,068.6	¥2,078.7	¥2,463.2	¥2,455.1
Total IC	¥1,589.2	¥1,563.0	¥1,588.4	¥1,616.7	¥1,927.8	¥1,929.1
Bipolar Digital (Tech)	¥ 236.8	¥ 226.9	¥ 217.4	¥ 208.1	¥ 250.1	¥ 244.8
TTL	111.4	104.2	118.3	89.9	105.3	99.8
ECL	83.2	85.0	61.1	87.0	109.2	111.4
Other	42.2	37.7	38.0	31.2	35.6	33.6
Bipolar Digital (Func)	¥ 236.8	¥ 226.9	¥ 217.4	¥ 208.1	¥ 250.1	¥ 244.8
Memory	31.3	29.8	26.2	25.9	29.9	29.0
Logic	205.5	197.1	191.2	182.2	220.2	215.8
MOS (Tech)	¥ 886.9	¥ 855.6	¥ 872.4	¥ 922.6	¥1,134.8	¥1,137.5
NMOS	571.9	539.1	503.5	471.5	493.7	408.4
PMOS	16.6	14.2	3.4	8.4	6.9	4.4
CMOS	298.4	302.3	365.5	442.7	634.2	724.7
MOS (Func)	¥ 886.9	¥ 855.6	¥ 872.4	¥ 922.6	¥1,134.8	¥1,137.5
Memory	404.1	322.0	289.2	292.9	368.2	385.5
Micro Device	216.4	222.8	258.2	286.0	340.7	330.4
Logic	266.4	310.8	325.0	343.7	425.9	421.6
Linear	¥ 465.5	¥ 480.5	¥ 498.6	¥ 486.0	¥ 542.9	¥ 546.8
Total Discrete	¥ 395.5	¥ 375.1	¥ 360.0	¥ 343.3	¥ 392.4	¥ 385.8
Total Optoelectronic	¥ 111.6	¥ 110.9	¥ 120.2	¥ 118.7	¥ 143.0	¥ 140.2

Source: Dataquest
December 1987

Semiconductor Consumption

Table 4c

Japanese Semiconductor Consumption
(Billions of Yen)

	1990	1991	1992	CAGR (87-92)	1997	CAGR (92-97)
Total Semiconductor	¥2,771.1	¥3,240.0	¥3,881.5	13.3%	¥7,151.4	13.0%
Total IC	¥2,198.8	¥2,596.4	¥3,164.7	14.4%	¥6,159.1	14.2%
Bipolar Digital (Tech)	¥ 273.7	¥ 312.4	¥ 364.6	11.9%	¥ 607.0	10.7%
TTL	104.8	115.5	134.7	8.4%	182.1	6.2%
ECL	135.4	156.3	182.3	15.9%	376.2	15.6%
Other	33.5	40.6	47.6	8.8%	48.7	0.5%
Bipolar Digital (Func)	¥ 273.7	¥ 312.4	¥ 364.6	11.9%	¥ 607.0	10.7%
Memory	29.7	31.8	33.5	5.3%	39.7	3.5%
Logic	244.0	280.6	331.1	12.7%	567.3	11.4%
MOS (Tech)	¥1,336.7	¥1,631.9	¥2,090.7	17.8%	¥4,729.8	17.7%
NMOS	379.6	418.5	536.1	2.6%	756.8	7.1%
PMOS	4.1	3.4	4.7	(11.0%)	3.2	(7.4%)
CMOS	953.0	1,210.0	1,549.9	28.5%	3,969.8	20.7%
MOS (Func)	¥1,336.7	¥1,631.9	¥2,090.7	17.8%	¥4,729.8	17.7%
Memory	446.9	535.3	724.9	19.9%	1,471.0	15.2%
Micro Device	396.5	499.6	649.4	17.8%	1,577.7	19.4%
Logic	493.3	597.0	716.4	15.8%	1,681.1	18.6%
Linear	¥ 588.4	¥ 652.1	¥ 709.4	7.9%	¥ 822.3	3.0%
Total Discrete	¥ 414.4	¥ 462.1	¥ 504.5	8.0%	¥ 625.5	4.4%
Total Optoelectronic	¥ 157.9	¥ 181.5	¥ 212.3	12.3%	¥ 366.8	11.6%

Source: Dataquest
December 1987

Semiconductor Consumption

Table 5b

Western European Semiconductor Consumption
(Millions of Dollars)

	1984	1985	1986	1987	1988	1989
Total Semiconductor	$4,805	$4,720	$5,532	$6,780	$8,066	$8,158
Total IC	$3,634	$3,556	$4,088	$5,126	$6,202	$6,415
Bipolar Digital (Tech)	$ 724	$ 709	$ 782	$ 978	$1,121	$1,075
TTL						
ECL						
Other						
Bipolar Digital (Func)	$ 724	$ 709	$ 782	$ 978	$1,121	$1,075
Memory	149	157	172	182	210	201
Logic	575	552	610	796	911	874
MOS (Technology)	$2,092	$1,953	$2,280	$2,942	$3,783	$4,035
NMOS						
PMOS						
CMOS						
MOS (Function)	$2,092	$1,953	$2,280	$2,942	$3,783	$4,035
Memory	995	750	822	1,043	1,344	1,420
Micro Device	465	485	578	726	929	1,005
Logic	632	718	880	1,173	1,510	1,610
Linear	$ 818	$ 894	$1,026	$1,206	$1,298	$1,305
Total Discrete	$ 963	$ 954	$1,153	$1,314	$1,468	$1,360
Total Optoelectronic	$ 208	$ 210	$ 291	$ 340	$ 396	$ 383

Source: Dataquest
December 1987

Semiconductor Consumption

Table 5c

Western European Semiconductor Consumption
(Millions of Dollars)

	1990	1991	1992	CAGR (87-92)	1997	CAGR (92-97)
Total Semiconductor	$9,192	$10,782	$12,900	13.7%	$24,145	13.4%
Total IC	$7,364	$ 8,878	$10,830	16.1%	$21,645	14.9%
Bipolar Digital (Tech)	$1,183	$ 1,321	$ 1,515	9.1%	$ 2,245	8.2%
TTL						
ECL						
Other						
Bipolar Digital (Func)	$1,183	$ 1,321	$ 1,515	9.1%	$ 2,245	8.2%
Memory	209	221	240	5.7%	270	2.4%
Logic	974	1,100	1,275	9.9%	1,975	9.1%
MOS (Technology)	$4,776	$ 5,974	$ 7,565	20.8%	$16,700	17.2%
NMOS						
PMOS						
CMOS						
MOS (Function)	$4,776	$ 5,974	$ 7,565	20.8%	$16,700	17.2%
Memory	1,685	2,132	2,740	21.3%	4,500	10.4%
Micro Device	1,203	1,618	2,150	24.3%	5,300	19.8%
Logic	1,888	2,224	2,675	17.9%	6,900	20.9%
Linear	$1,405	$ 1,583	$ 1,750	7.7%	$ 2,700	9.1%
Total Discrete	$1,420	$ 1,479	$ 1,600	4.0%	$ 1,800	2.4%
Total Optoelectronic	$ 408	$ 425	$ 470	6.7%	$ 700	8.3%

Source: Dataquest
December 1987

Semiconductor Consumption

Table 6a

Rest of World Semiconductor Consumption
(Millions of Dollars)

	1978	1979	1980	1981	1982	1983
Total Semiconductor	$660	$790	$996	$963	$1,042	$1,503
Total IC	$258	$364	$450	$494	$ 585	$ 959
Bipolar Digital (Tech)	$ 45	$ 79	$108	$106	$ 113	$ 162
TTL						
ECL						
Other						
Bipolar Digital (Func)	$ 45	$ 79	$108	$106	$ 113	$ 162
Memory		2	3	3	4	4
Logic		77	105	103	109	158
MOS (Technology)	$110	$100	$143	$171	$ 248	$ 450
NMOS						
PMOS						
CMOS						
MOS (Function)	$110	$100	$143	$171	$ 248	$ 450
Memory		25	34	51	106	194
Micro Device		17	27	43	63	112
Logic		58	82	77	79	144
Linear	$103	$185	$199	$217	$ 224	$ 347
Total Discrete	$346	$334	$416	$355	$ 345	$ 419
Total Optoelectronic	$ 56	$ 92	$130	$114	$ 112	$ 125

Source: Dataquest
December 1987

Semiconductor Consumption

Table 6b

Rest of World Semiconductor Consumption
(Millions of Dollars)

	1984	1985	1986	1987	1988	1989
Total Semiconductor	$2,298	$1,897	$2,920	$4,911	$6,943	$6,992
Total IC	$1,474	$1,155	$1,887	$3,387	$4,877	$4,952
Bipolar Digital (Tech)	$ 246	$ 131	$ 220	$ 430	$ 623	$ 604
TTL						
ECL						
Other						
Bipolar Digital (Func)	$ 246	$ 131	$ 220	$ 430	$ 623	$ 604
Memory	7	6	12	18	25	24
Logic	239	125	208	412	598	580
MOS (Technology)	$ 825	$ 627	$1,084	$1,912	$2,870	$2,949
NMOS						
PMOS						
CMOS						
MOS (Function)	$ 825	$ 627	$1,084	$1,912	$2,870	$2,949
Memory	313	136	227	404	595	580
Micro Device	164	135	280	457	713	728
Logic	348	356	577	1,051	1,562	1,641
Linear	$ 403	$ 397	$ 583	$1,045	$1,384	$1,399
Total Discrete	$ 695	$ 622	$ 866	$1,315	$1,789	$1,772
Total Optoelectronic	$ 129	$ 120	$ 167	$ 209	$ 277	$ 268

Source: Dataquest
December 1987

Semiconductor Consumption

Table 6c

Rest of World Semiconductor Consumption
(Millions of Dollars)

	1990	1991	1992	CAGR (87-92)	1997	CAGR (92-97)
Total Semiconductor	$8,299	$10,295	$12,904	21.3%	$19,158	8.2%
Total IC	$6,011	$ 7,627	$ 9,821	23.7%	$16,108	10.4%
Bipolar Digital (Tech)	$ 722	$ 893	$ 1,125	21.2%	$ 1,208	1.4%
TTL						
ECL						
Other						
Bipolar Digital (Func)	$ 722	$ 893	$1,125	21.2%	$ 1,208	1.4%
Memory	26	30	37	15.5%	58	9.3%
Logic	696	863	1,088	21.4%	1,150	1.1%
MOS (Technology)	$3,652	$4,755	$6,287	26.9%	$12,300	14.4%
NMOS						
PMOS						
CMOS						
MOS (Function)	$3,652	$4,755	$6,287	26.9%	$12,300	14.4%
Memory	700	882	1,150	23.3%	3,400	24.2%
Micro Device	917	1,228	1,646	29.2%	3,100	13.5%
Logic	2,035	2,645	3,491	27.1%	5,800	10.7%
Linear	$1,637	$1,979	$2,409	18.2%	$ 2,600	1.5%
Total Discrete	$1,984	$2,308	$2,653	9.7%	$ 2,500	8.8%
Total Optoelectronic	$ 304	$ 360	$ 430	11.4%	$ 550	10.4%

Source: Dataquest
December 1987

Table 7a

Worldwide Average Selling Prices
(Dollars)

	1978	1979	1980	1981	1982	1983
Total Semiconductor	$0.28	$0.29	$0.33	$0.31	$0.34	$0.32
Total IC	$1.01	$0.97	$1.07	$1.02	$1.01	$1.04
Bipolar Digital (Tech)	$0.63	$0.57	$0.70	$0.70	$0.62	$0.65
TTL						
ECL						
Other						
Bipolar Digital (Func)	$0.63	$0.57	$0.70	$0.70	$0.62	$0.65
Memory						
Logic						
MOS (Technology)	$1.91	$1.93	$1.81	$1.66	$1.71	$1.72
NMOS	4.46	3.66	3.08	3.06	2.86	3.11
PMOS	1.92	1.80	1.75	1.70	1.70	1.75
CMOS	0.64	0.78	0.79	0.74	0.78	0.80
MOS (Function)	$1.91	$1.93	$1.81	$1.66	$1.71	$1.72
Memory		5.15	4.90	3.17	3.06	3.21
Micro Device		3.96	3.61	3.40	3.34	3.40
Logic		0.89	0.85	0.86	0.80	0.79
Linear	$0.84	$0.78	$0.83	$0.81	$0.79	$0.76
Total Discrete	$0.13	$0.12	$0.12	$0.11	$0.11	$0.09
Total Optoelectronic	$0.47	$0.51	$0.44	$0.39	$0.38	$0.37

Source: Dataquest
December 1987

Semiconductor Consumption

Table 7b

Worldwide Average Selling Prices
(Dollars)

	1984	1985	1986	1987	1988	1989
Total Semiconductor	$0.36	$0.34	$0.35	$0.39	$0.41	$0.40
Total IC	$1.11	$1.07	$1.12	$1.18	$1.24	$1.22
Bipolar Digital (Tech)	$0.65	$0.71	$0.71	$0.70	$0.71	$0.70
TTL						
ECL						
Other						
Bipolar Digital (Func)	$0.65	$0.71	$0.71	$0.70	$0.71	$0.70
Memory						
Logic						
MOS (Technology)	$2.02	$1.68	$1.74	$1.94	$2.03	$1.96
NMOS	3.68	2.59	2.54	3.12	3.12	2.77
PMOS	1.75	1.75	1.70	1.70	1.65	1.65
CMOS	0.99	1.07	1.22	1.41	1.63	1.73
MOS (Function)	$2.02	$1.68	$1.74	$1.94	$2.03	$1.96
Memory	3.90	2.59	2.40	2.90	3.15	2.90
Micro Device	4.41	3.91	4.10	4.35	4.51	4.20
Logic	0.85	0.93	1.05	1.17	1.22	1.22
Linear	$0.75	$0.76	$0.84	$0.83	$0.83	$0.84
Total Discrete	$0.09	$0.09	$0.10	$0.10	$0.10	$0.10
Total Optoelectronic	$0.36	$0.33	$0.34	$0.33	$0.33	$0.30

Source: Dataquest
December 1987

Semiconductor Consumption

Table 7c

Worldwide Average Selling Prices
(Dollars)

	1990	1991	1992	CAGR (87-92)	1997	CAGR (92-97)
Total Semiconductor	$0.43	$0.46	$0.50	6.0%	$0.77	8.8%
Total IC	$1.30	$1.36	$1.44	4.0%	$1.80	4.5%
Bipolar Digital (Tech)	$0.74	$0.77	$0.79	2.4%	$0.86	1.7%
TTL						
ECL						
Other						
Bipolar Digital (Func)	$0.74	$0.77	$0.79	2.4%	$0.86	1.7%
Memory						
Logic						
MOS (Technology)	$2.08	$2.17	$2.31	3.6%	$2.76	3.6%
NMOS	3.07	2.98	2.41	(5.0%)	1.15	(13.7%)
PMOS	1.65	1.65	1.60	(1.2%)	1.00	(9.0%)
CMOS	1.91	2.08	2.30	10.3%	2.80	4.0%
MOS (Function)	$2.08	$2.17	$2.31	3.6%	$2.76	3.6%
Memory	3.05	3.10	3.30	2.6%	3.90	3.4%
Micro Device	4.25	4.30	4.50	0.7%	4.80	1.3%
Logic	1.31	1.38	1.45	4.4%	1.80	4.4%
Linear	$0.86	$0.88	$0.89	1.4%	$0.95	1.3%
Total Discrete	$0.10	$0.10	$0.10	1.8%	$0.12	3.6%
Total Optoelectronic	$0.32	$0.34	$0.35	1.2%	$0.37	1.1%

Source: Dataquest
December 1987

Semiconductor Consumption

Table 8a

Worldwide Semiconductor Consumption
(Millions of Units)

	1978	1979	1980	1981	1982	1983
Total Semiconductor	$31,461	$37,703	$42,870	$48,081	$45,195	$60,779
Total IC	$ 5,171	$ 7,242	$ 8,955	$ 9,809	$10,791	$14,110
Bipolar Digital (Tech)	$ 2,002	$ 2,937	$ 3,391	$ 3,339	$ 3,890	$ 4,612
TTL						
ECL						
Other						
Bipolar Digital (Func)	$ 2,002	$ 2,937	$ 3,391	$ 3,339	$ 3,890	$ 4,612
Memory						
Logic						
MOS (Technology)	$ 1,221	$ 1,731	$ 2,603	$ 2,906	$ 3,306	$ 4,665
NMOS	305	597	1,041	1,042	1,375	1,778
PMOS	299	276	287	265	221	182
CMOS	617	858	1,275	1,598	1,709	2,704
MOS (Function)	$ 1,221	$ 1,731	$ 2,603	$ 2,906	$ 3,306	$ 4,665
Memory		325	455	655	883	1,150
Micro Device		137	239	319	395	592
Logic		1,269	1,909	1,933	2,029	2,923
Linear	$ 1,949	$ 2,574	$ 2,960	$ 3,564	$ 3,595	$ 4,833
Total Discrete	$25,392	$29,350	$32,358	$36,227	$32,245	$43,878
Total Optoelectronic	$ 898	$ 1,111	$1,557	$2,045	$2,159	$2,791

Source: Dataquest
December 1987

Semiconductor Consumption

Table 8b

Worldwide Semiconductor Consumption
(Millions of Units)

	1984	1985	1986	1987	1988	1989
Total Semiconductor	$80,097	$73,197	$83,866	$101,940	$116,986	$119,157
Total IC	$20,425	$17,809	$21,010	$ 25,193	$ 30,208	$ 30,618
Bipolar Digital (Tech)	$ 7,403	$ 5,351	$ 6,086	$ 7,373	$ 8,813	$ 8,793
TTL						
ECL						
Other						
Bipolar Digital (Func)	$ 7,403	$ 5,351	$ 6,086	$ 7,373	$ 8,813	$ 8,793
Memory						
Logic						
MOS (Technology)	$ 6,453	$ 6,186	$ 7,524	$ 8,938	$ 11,045	$ 11,530
NMOS	2,414	2,468	2,917	2,744	2,999	2,591
PMOS	161	83	66	59	50	41
CMOS	3,879	3,635	4,541	6,135	7,996	8,898
MOS (Function)	$ 6,453	$ 6,186	$ 7,524	$ 8,938	$ 11,045	$ 11,530
Memory	1,605	1,549	1,808	1,906	2,291	2,483
Micro Device	739	704	893	1,115	1,390	1,476
Logic	4,108	3,933	4,824	5,918	7,363	7,570
Linear	$ 6,569	$ 6,272	$ 7,400	$ 8,882	$ 10,351	$ 10,295
Total Discrete	$56,156	$51,889	$58,180	$ 71,189	$ 79,910	$ 81,563
Total Optoelectronic	$ 3,516	$ 3,499	$ 4,676	$ 5,558	$ 6,868	$ 6,977

Source: Dataquest
December 1987

Semiconductor Consumption

Table 8c

Worldwide Semiconductor Consumption
(Millions of Units)

	1990	1991	1992	CAGR (87-92)	1997	CAGR (92-97)
Total Semiconductor	$126,153	$136,187	$150,403	8.1%	$171,930	2.7%
Total IC	$ 33,290	$ 37,594	$ 43,319	11.4%	$ 64,124	8.2%
Bipolar Digital (Tech)	$ 9,328	$ 10,326	$ 11,904	10.1%	$ 17,017	7.4%
TTL						
ECL						
Other						
Bipolar Digital (Func)	$ 9,328	$ 10,326	$ 11,904	10.1%	$ 17,017	7.4%
Memory						
Logic						
MOS (Technology)	$ 12,791	$ 14,975	$ 17,724	14.7%	$ 31,033	11.9%
NMOS	1,887	1,508	1,679	(9.4%)	745	(15.0%)
PMOS	38	35	31	(12.1%)	1	(49.8%)
CMOS	10,866	13,432	16,014	21.2%	30,287	13.6%
MOS (Function)	$ 12,791	$ 14,975	$ 17,724	14.7%	$ 31,033	11.9%
Memory	2,709	3,187	3,823	14.9%	6,256	10.4%
Micro Device	1,748	2,171	2,673	19.1%	5,555	15.8%
Logic	8,334	9,616	11,228	13.7%	19,222	11.4%
Linear	$ 11,171	$ 12,293	$ 13,691	9.0%	$ 16,074	3.3%
Total Discrete	$ 85,663	$ 90,990	$ 98,615	6.7%	$ 94,863	(0.8%)
Total Optoelectronic	$ 7,200	$ 7,603	$ 8,469	8.8%	$ 12,943	8.9%

Source: Dataquest
December 1987

Semiconductor Consumption

INTRODUCTION

Semiconductor consumption data comprise a set of detailed tables that estimate consumption worldwide and for four major geographical regions for the years 1978 through 1992 and 1997. Semiconductor consumption tables contain both historical data and forecasts. Historical data begin with 1978 and end with 1986, while forecast data provide annual market size estimates for 1987 through 1992, with additional estimates for 1997. Below is a list of tables detailing the type of data, region, time period, and units of measure.

LIST OF TABLES

Table	Region Covered	Years	Units
0	Japan and Western Europe Exchange Rates	1970-1986	Various
1a	Worldwide Consumption	1978-1983	Dollars
1b	Worldwide Consumption	1984-1989	Dollars
1c	Worldwide Consumption	1990-1992; 1997	Dollars
2a	North American Consumption	1978-1983	Dollars
2b	North American Consumption	1984-1989	Dollars
2c	North American Consumption	1990-1992; 1997	Dollars
3a	Japanese Consumption	1978-1983	Dollars
3b	Japanese Consumption	1984-1989	Dollars
3c	Japanese Consumption	1990-1992; 1997	Dollars
4a	Japanese Consumption	1978-1983	Yen
4b	Japanese Consumption	1984-1989	Yen
4c	Japanese Consumption	1990-1992; 1997	Yen
5a	Western European Consumption	1978-1983	Dollars
5b	Western European Consumption	1984-1989	Dollars
5c	Western European Consumption	1990-1992; 1997	Dollars
6a	Rest of World Consumption	1978-1983	Dollars
6b	Rest of World Consumption	1984-1989	Dollars
6c	Rest of World Consumption	1990-1992; 1997	Dollars
7a	Worldwide Average Selling Prices	1978-1983	Dollars
7b	Worldwide Average Selling Prices	1984-1989	Dollars
7c	Worldwide Average Selling Prices	1990-1992; 1997	Dollars
8a	Worldwide Consumption	1978-1983	Units
8b	Worldwide Consumption	1984-1989	Units
8c	Worldwide Consumption	1990-1992; 1997	Units

Semiconductor Consumption

Each table gives estimates of semiconductor consumption listed by the major semiconductor device product categories. In these tables, semiconductor components are divided into three major product groups: integrated circuits, discrete devices, and optoelectronic devices. These groups are divided into a number of subgroups, some of which are segmented further.

DEFINITIONS AND CONVENTIONS

Dataquest uses a common manufacturer base for all data tables. This base includes all suppliers to the merchant semiconductor market. It excludes captive suppliers that manufacture devices solely for the benefit of the parent company, such as AT&T, Burroughs, Delco, and IBM. Included, however, are companies that actively market semiconductor devices to the merchant market as well as to other divisions of their own companies. For such companies, both external shipments and internal consumption are included. Devices that are used internally are valued at current market prices.

Consumption--Dataquest defines consumption as the purchase of a semiconductor device or devices. This definition must be differentiated from actual use of the device in a final product. Devices that are inventoried at the user level are considered consumption according to our definition.

Hybrids--In earlier consumption data, hybrid devices were included as a separate segment of integrated circuits. However, since hybrid devices are primarily a special packaging arrangement, this segment has been omitted. Hybrid devices manufactured by semiconductor companies are now included in the most appropriate product segment, usually the linear segment.

Power Devices--The difference between low-power and high-power transistors is set at the 1-watt power-handling capability. Power diodes are rated at 1 amp or higher; small-signal diodes are rated at less than 1 amp. Special discrete devices that are neither transistors, diodes, nor thyristors are categorized as "other discretes."

The manufacturer base product group definitions and guidelines for including value of output that we have used in our tables may differ from those used in other studies of this type. Our base is nearly the same as that used by the World Semiconductor Trade Statistics program (WSTS).

Semiconductor Consumption

Regions--North America is defined as including both the United States and Canada. Latin America, including Mexico, is considered part of the Rest of World (ROW) category. Western Europe includes Austria, Belgium, the Federal Republic of Germany, France, Greece, Italy, Luxembourg, the Scandinavian countries (Denmark, Finland, Norway, Sweden), Spain, and the United Kingdom.

DATA SOURCES

The information presented in the consumption data has been consolidated from a variety of sources, each of which focuses on a specific part of the market. These sources include the following:

- World Semiconductor Trade Statistics (WSTS) data, and Dataquest's estimates of regional company sales are used to determine North American consumption.
- Japanese trade statistics compiled and published by the Ministry of Finance (MOF), and the Ministry of International Trade and Industry (MITI), WSTS data, and Dataquest's estimates of regional company sales are used to determine Japanese consumption.
- For Western European markets, marketing statistics from WSTS data, and Dataquest's estimates of regional company sales are used to determine consumption.
- In ROW, the major published sources used to estimate consumption are WSTS data and Dataquest's estimates of company shipments into the region.

Dataquest believes that the estimates presented here are the most accurate and meaningful generally available today. The sources of the data and the guidelines for the forecasts presented in the tables are:

- Unit sales or revenue (or both) published by major industry participants, both in the United States and abroad
- Estimates presented by knowledgeable and reliable industry spokesmen
- Government data or trade association data such as those from the Electronics Industry Association (EIA), MITI, WSTS, and the U.S. Department of Commerce

Semiconductor Consumption

- Published product literature and price lists
- Interviews with knowledgeable manufacturers, distributors, and users
- Relevant projected world economic data

CONSISTENCY

One of the key objectives in preparing these estimates is to achieve consistency among the various data elements that constitute the forecast and the historical data base. To ensure the accuracy and consistency of the estimates, we have compared the value of directly obtained data elements with values obtained by indirect means, wherever possible. Thus, the worldwide totals in the consumption analysis are consistent with the worldwide totals of the market share analysis.

ACCURACY

The tables presented here represent Dataquest estimates that we believe are reasonably accurate. Where we have no reasonable estimate, none is given. A blank space in a table indicates that a reasonably accurate estimate is unavailable, and a zero in a table represents an estimate.

VALUATION OF CONSUMPTION

Regional consumption is expressed in U.S. dollars, (Japanese consumption and shipments are, however, also expressed in yen). To make the tables in this study useful in comparing different regions, it is necessary to express all values in a common currency and, we chose the U.S. dollar for convenience.

However, the choice of the U.S. dollar (or any single currency, for that matter) as the currency basis for the tables, brings with it some problems that require the readers' careful consideration in interpreting the data.

Inflation

All countries that participate significantly in international semiconductor markets suffered from an overall price inflation in the 1970s, continuing into the 1980s.

As a consequence, the dollar in a given year is not truly comparable with the dollar in any preceding year. Consumer and wholesale price indices and GNP deflators all measure price changes in various composite "market baskets" of goods. However, there is no price index that measures price changes of material, equipment, and labor inputs to the semiconductor industry. Indeed, the "mix" is changing so rapidly that what is used this year was sometimes unavailable last year, at any price. Nor is there a composite price index that measures price changes in aggregate semiconductor product. In an industry noted for its deflationary trends, this latter effect would tend to make the component purchaser's dollar worth more as time passed, in terms of purchasing ability.

We have made no adjustments in the historical data to account for these inflationary and deflationary effects. The data are expressed in current dollars (dollars that include the inflation rate and exchange rates of the given year) for all historical data; comparisons between different years must be interpreted accordingly.

Average Selling Prices

When considering the worldwide average selling prices (ASPs) for semiconductor components, one must look at the price per function of a circuit, the complexity of the circuit, and the product mix according to this increasing complexity. It is true that one characteristic of the semiconductor industry is that the price per function for integrated circuits has been dropping an average of 30 percent per year for the last 15 years. At the same time, circuits have become denser, resulting in an overall increase in the price of a device with a decreasing cost per function. Thus, Table 7 shows the worldwide ASPs increasing after many years of decreasing, due to the move toward higher-complexity devices. There are also regional differences in ASPs due to regional competition differences and the varying regional product consumption mix. The worldwide ASP is truly an aggregate measure and may differ significantly from ASPs in any specific market at any point in time.

Exchange Rates

Construction of the West European tables involves combining data from many countries, each of which has different and changing exchange rates. Dataquest uses Annual Foreign Exchange Rates for each year as published by The International Monetary Fund. As far as possible, we prepare our estimates in terms of local currencies before conversion to U.S. dollars. The exchange rates for major currencies can be found in Table 0 at the end of this introduction.

Semiconductor Consumption

Japanese consumption is based on MITI data, originally expressed in yen. The Japanese data published in this study are expressed in both dollars (Tables 3a, 3b, and 3c) and in yen (Tables 4a, 4b, and 4c). The yen/dollar exchange rate used for each year can be found in Table 0. Because of the fluctuations in the exchange rate for the yen, the dollar values given tend to distort the growth rate of the Japanese market, but they do provide a useful basis for regional market size comparisons. However, the data in yen give a better picture of the real growth in the Japanese market.

FORECAST

As mentioned previously, historical data are expressed in current dollars or dollars that include the given year's inflation rate and exchange rates. However, the consumption forecasts use constant dollars and exchange rates, with no allowance for inflation or variations in the rates of exchange between countries. All estimates for 1987 and beyond are made as if 1987 monetary conditions will continue through 1997 and, therefore, show the absolute year-to-year growth during this period.

Semiconductor Consumption

Table 0

FOREIGN EXCHANGE RATES
(In US Dollars)

Year	Yrly/ Qtrly	Japan (US$ per Yen)	France (US$ per Franc)	West Germany (US$ per Deutsche Mark)	United Kingdom (US$ per Pound Sterling)	European Basket ECU (1980 = 100)
1970	YR	$0.002795	$0.1808	$0.2740	$2.3810	
1971	YR	$0.002913	$0.1815	$0.2874	$2.4390	
1972	YR	$0.003311	$0.1984	$0.3135	$2.5000	
1973	YR	$0.003721	$0.2247	$0.3745	$2.4390	
1974	YR	$0.003427	$0.2079	$0.3861	$2.3256	
1975	YR	$0.003368	$0.2331	$0.4065	$2.2222	
1976	YR	$0.003376	$0.2092	$0.3968	$1.8182	
1977	YR	$0.003761	$0.2037	$0.4310	$1.7544	
1978	YR	$0.004857	$0.2217	$0.4975	$1.9231	
1979	YR	$0.004518	$0.2353	$0.5464	$2.1277	
1980	YR	$0.004449	$0.2364	$0.5495	$2.3256	
1981	YR	$0.004519	$0.1842	$0.4425	$1.0408	
1982	YR	$0.004022	$0.1522	$0.4115	$1.7544	
1983	YR	$0.004203	$0.1312	$0.3922	$1.4085	
1984	YR	$0.004219	$0.1144	$0.3509	$1.3333	
1985	YR	$0.004202	$0.1144	$0.3401	$1.2821	$154.2
1986	Q1	$0.005319	$0.1387	$0.4255	$1.4493	$154.2
1986	Q2	$0.005882	$0.1399	$0.4444	$1.5152	$148.5
1986	Q3	$0.006410	$0.1475	$0.4808	$1.4925	$141.4
1986	Q4	$0.006250	$0.1522	$0.4975	$1.4286	$139.4
1986	YR	$0.005988	$0.1443	$0.4608	$1.4706	$145.9
1987	Q1	$0.006494	$0.1608	$0.5376	$1.5152	$130.9

Source: The International Monetary Fund
Dataquest
May 1987

Semiconductor Consumption

Table 1a

WORLDWIDE SEMICONDUCTOR CONSUMPTION
(Millions of Dollars)

	1978	1979	1980	1981	1982	1983
Total Semiconductor	$8,953	$11,114	$14,118	$14,828	$15,261	$19,665
Total IC	$5,230	$ 7,028	$ 9,546	$10,046	$10,894	$14,684
Bipolar Digital (Tech)	$1,261	$ 1,674	$ 2,374	$ 2,337	$ 2,412	$ 2,998
TTL	990	1,365	1,930	1,823	1,889	2,423
ECL	138	170	300	376	391	445
Other	133	139	144	138	132	130
Bipolar Digital (Func)	$1,261	$ 1,674	$ 2,374	$ 2,337	$ 2,412	$ 2,998
Memory		324	572	558	511	593
Logic		1,350	1,802	1,779	1,901	2,405
MOS (Technology)	$2,332	$ 3,346	$ 4,715	$ 4,822	$ 5,642	$ 8,013
NMOS	1,361	2,184	3,207	3,190	3,902	5,496
PMOS	574	497	503	451	376	319
CMOS	397	665	1,005	1,181	1,364	2,198
MOS (Function)	$2,332	$ 3,346	$ 4,715	$ 4,822	$ 5,642	$ 8,013
Memory		1,676	2,230	2,075	2,701	3,691
Micro Device		541	862	1,085	1,318	2,013
Logic		1,129	1,623	1,662	1,623	2,309
Linear	$1,637	$ 2,008	$ 2,457	$ 2,887	$ 2,840	$ 3,673
Total Discrete	$3,301	$ 3,522	$ 3,883	$ 3,985	$ 3,547	$ 3,949
Total Optoelectronic	$ 422	$ 564	$ 689	$ 797	$ 820	$ 1,032

Source: Dataquest
May 1987

Semiconductor Consumption

Table 1b

WORLDWIDE SEMICONDUCTOR CONSUMPTION
(Millions of Dollars)

	1984	1985	1986	1987	1988	1989
Total Semiconductor	$29,087	$24,823	$31,009	$36,667	$44,261	$44,284
Total IC	$22,753	$18,988	$23,601	$28,449	$34,948	$35,200
Bipolar Digital (Tech)	$ 4,812	$ 3,799	$ 4,321	$ 4,963	$ 6,042	$ 5,950
TTL	4,067	3,058	3,478			
ECL	607	607	690			
Other	138	134	152			
Bipolar Digital (Func)	$ 4,812	$ 3,799	$ 4,321	$ 4,963	$ 6,042	$ 5,950
Memory	719	603	675	783	905	891
Logic	4,093	3,196	3,646	4,180	5,137	5,059
MOS (Technology)	$13,014	$10,422	$13,064	$16,687	$21,216	$21,515
NMOS	8,850	6,488	7,269	8,344	8,911	6,885
PMOS	281	146	112	101	83	68
CMOS	3,883	3,788	5,683	8,243	12,222	14,562
MOS (Function)	$13,014	$10,422	$13,064	$16,687	$21,216	$21,515
Memory	6,261	4,013	4,338	5,491	7,142	7,010
Micro Device	3,261	2,751	3,661	4,637	5,870	6,035
Logic	3,492	3,658	5,065	6,559	8,204	8,470
Linear	$ 4,927	$ 4,767	$ 6,216	$ 6,799	$ 7,690	$ 7,735
Total Discrete	$ 5,054	$ 4,670	$ 5,818	$ 6,474	$ 7,251	$ 7,060
Total Optoelectronic	$ 1,280	$ 1,165	$ 1,590	$ 1,744	$ 2,062	$ 2,024

Source: Dataquest
May 1987

Semiconductor Consumption

Table 1c

WORLDWIDE SEMICONDUCTOR CONSUMPTION
(Millions of Dollars)

	1990	1991	1992	CAGR (87-92)	1997	CAGR (92-97)
Total Semiconductor	$50,166	$58,853	$70,546	14.0%	$132,119	13.4%
Total IC	$40,428	$48,214	$58,778	15.6%	$115,567	14.5%
Bipolar Digital (Tech)	$ 6,544	$ 7,548	$ 8,912	12.4%	$ 14,635	10.4%
TTL						
ECL						
Other						
Bipolar Digital (Func)	$ 6,544	$ 7,548	$ 8,912	12.4%	$ 14,635	10.4%
Memory	925	1,005	1,119	7.4%	1,461	5.5%
Logic	5,619	6,543	7,793	13.3%	13,174	11.1%
MOS (Technology)	$25,488	$31,380	$39,510	18.8%	$ 85,662	16.7%
NMOS	5,607	4,393	3,951	(13.9%)	857	(26.3%)
PMOS	63	57	50	(13.1%)	1	(54.3%)
CMOS	19,818	26,930	35,509	33.9%	84,804	19.0%
MOS (Function)	$25,488	$31,380	$39,510	18.8%	$ 85,662	16.7%
Memory	8,103	9,729	14,250	21.0%	24,400	11.4%
Micro Device	7,209	9,350	13,100	23.1%	26,662	15.3%
Logic	10,176	12,301	16,640	20.5%	34,600	15.8%
Linear	$ 8,396	$ 9,286	$10,356	8.8%	$ 15,270	8.1%
Total Discrete	$ 7,517	$ 8,179	$ 8,942	6.7%	$ 11,763	5.6%
Total Optoelectronic	$ 2,221	$ 2,460	$ 2,826	10.1%	$ 4,789	11.1%

Source: Dataquest
May 1987

Semiconductor Consumption

Table 2a

NORTH AMERICAN SEMICONDUCTOR CONSUMPTION
(Millions of Dollars)

	1978	1979	1980	1981	1982	1983
Total Semiconductor	$3,506	$4,538	$6,053	$6,529	$6,970	$9,141
Total IC	$2,335	$3,179	$4,562	$4,867	$5,466	$7,400
Bipolar Digital (Tech)	$ 666	$ 901	$1,411	$1,339	$1,367	$1,729
TTL						
ECL						
Other						
Bipolar Digital (Func)	$ 666	$ 901	$1,411	$1,339	$1,367	$1,729
Memory		185	396	375	320	423
Logic		716	1,015	964	1,047	1,306
MOS (Technology)	$1,099	$1,703	$2,442	$2,595	$3,183	$4,416
NMOS						
PMOS						
CMOS						
MOS (Function)	$1,099	$1,703	$2,442	$2,595	$3,183	$4,416
Memory		1,028	1,230	1,107	1,592	2,051
Micro Device		186	377	489	641	1,068
Logic		489	835	999	950	1,297
Linear	$ 570	$ 575	$ 709	$ 933	$ 916	$1,255
Total Discrete	$1,005	$1,161	$1,289	$1,398	$1,221	$1,397
Total Optoelectronic	$ 166	$ 198	$ 202	$ 264	$ 283	$ 344

Source: Dataquest
May 1987

Semiconductor Consumption

Table 2b

NORTH AMERICAN SEMICONDUCTOR CONSUMPTION
(Millions of Dollars)

	1984	1985	1986	1987	1988	1989
Total Semiconductor	$13,139	$9,607	$10,201	$11,743	$14,326	$14,302
Total IC	$10,940	$7,710	$ 8,136	$ 9,511	$11,822	$11,872
Bipolar Digital (Tech)	$ 2,843	$2,006	$ 2,021	$ 2,186	$ 2,747	$ 2,690
TTL						
ECL						
Other						
Bipolar Digital (Func)	$ 2,843	$2,006	$ 2,021	$ 2,186	$ 2,747	$ 2,690
Memory	431	315	335	382	454	450
Logic	2,412	1,691	1,686	1,804	2,293	2,240
MOS (Technology)	$ 6,355	$4,247	$ 4,484	$ 5,527	$ 6,950	$ 7,085
NMOS						
PMOS						
CMOS						
MOS (Function)	$ 6,355	$4,247	$ 4,484	$ 5,527	$ 6,950	$ 7,085
Memory	3,248	1,774	1,560	1,785	2,213	2,190
Micro Device	1,719	1,195	1,262	1,566	2,018	2,075
Logic	1,388	1,278	1,662	2,176	2,719	2,820
Linear	$ 1,742	$1,457	$ 1,631	$ 1,798	$ 2,125	$ 2,097
Total Discrete	$ 1,727	$1,528	$ 1,649	$ 1,787	$ 1,984	$ 1,925
Total Optoelectronic	$ 472	$ 369	$ 416	$ 445	$ 520	$ 505

Source: Dataquest
May 1987

Semiconductor Consumption

Table 2c

NORTH AMERICAN SEMICONDUCTOR CONSUMPTION
(Millions of Dollars)

	1990	1991	1992	CAGR (87-92)	1997	CAGR (92-97)
Total Semiconductor	$15,998	$18,273	$21,470	12.8%	$37,770	12.0%
Total IC	$13,425	$15,507	$18,443	14.2%	$33,850	12.9%
Bipolar Digital (Tech)	$ 2,918	$ 3,335	$ 3,950	12.6%	$ 6,850	11.6%
TTL						
ECL						
Other						
Bipolar Digital (Func)	$ 2,918	$ 3,335	$ 3,950	12.6%	$ 6,850	11.6%
Memory	468	515	590	9.1%	850	7.6%
Logic	2,450	2,820	3,360	13.2%	6,000	12.3%
MOS (Technology)	$ 8,176	$ 9,625	$11,619	16.0%	$22,900	14.5%
NMOS						
PMOS						
CMOS						
MOS (Function)	$ 8,176	$ 9,625	$11,619	16.0%	$22,900	14.5%
Memory	2,450	2,800	3,300	13.1%	6,000	12.7%
Micro Device	2,376	2,825	3,469	17.2%	7,000	15.1%
Logic	3,350	4,000	4,850	17.4%	9,900	15.3%
Linear	$ 2,331	$ 2,547	$ 2,874	9.8%	$ 4,100	7.4%
Total Discrete	$ 2,033	$ 2,181	$ 2,367	5.8%	$ 3,000	4.9%
Total Optoelectronic	$ 540	$ 585	$ 660	8.2%	$ 920	6.9%

Source: Dataquest
May 1987

Semiconductor Consumption

Table 3a

JAPANESE SEMICONDUCTOR CONSUMPTION
(Millions of Dollars)

	1978	1979	1980	1981	1982	1983
Total Semiconductor	$2,448	$2,768	$3,383	$4,295	$4,082	$5,651
Total IC	$1,399	$1,738	$2,201	$2,793	$2,855	$4,002
Bipolar Digital (Tech)	$ 259	$ 304	$ 345	$ 438	$ 498	$ 624
TTL						
ECL						
Other						
Bipolar Digital (Func)	$ 259	$ 304	$ 345	$ 438	$ 498	$ 624
Memory		52	57	77	87	59
Logic		252	288	361	411	565
MOS (Technology)	$ 588	$ 762	$ 991	$1,174	$1,263	$1,920
NMOS						
PMOS						
CMOS						
MOS (Function)	$ 588	$ 762	$ 991	$1,174	$1,263	$1,920
Memory		256	423	491	534	865
Micro Device		213	269	404	446	594
Logic		293	299	279	283	461
Linear	$ 552	$ 672	$ 865	$1,181	$1,094	$1,458
Total Discrete	$ 946	$ 889	$ 986	$1,237	$ 970	$1,267
Total Optoelectronic	$ 103	$ 141	$ 196	$ 265	$ 257	$ 382

Source: Dataquest
May 1987

Semiconductor Consumption

Table 3b

JAPANESE SEMICONDUCTOR CONSUMPTION
(Millions of Dollars)

	1984	1985	1986	1987	1988	1989
Total Semiconductor	$8,845	$8,599	$12,356	$14,239	$16,732	$16,656
Total IC	$6,705	$6,567	$ 9,490	$11,134	$13,244	$13,206
Bipolar Digital (Tech)	$ 999	$ 953	$ 1,298	$ 1,502	$ 1,793	$ 1,803
TTL						
ECL						
Other						
Bipolar Digital (Func)	$ 999	$ 953	$ 1,298	$ 1,502	$ 1,793	$ 1,803
Memory	132	125	156	193	222	218
Logic	867	828	1,142	1,309	1,571	1,585
MOS (Technology)	$3,742	$3,595	$ 5,216	$ 6,580	$ 8,121	$ 8,030
NMOS						
PMOS						
CMOS						
MOS (Function)	$3,742	$3,595	$ 5,216	$ 6,580	$ 8,121	$ 8,030
Memory	1,705	1,353	1,729	2,284	2,992	2,820
Micro Device	913	936	1,541	1,921	2,346	2,350
Logic	1,124	1,306	1,946	2,375	2,783	2,860
Linear	$1,964	$2,019	$ 2,976	$ 3,052	$ 3,330	$ 3,373
Total Discrete	$1,669	$1,566	$ 2,150	$ 2,342	$ 2,578	$ 2,550
Total Optoelectronic	$ 471	$ 466	$ 716	$ 763	$ 910	$ 900

Source: Dataquest
May 1987

Semiconductor Consumption

Table 3c

JAPANESE SEMICONDUCTOR CONSUMPTION
(Millions of Dollars)

	1990	1991	1992	CAGR (87-92)	1997	CAGR (92-97)
Total Semiconductor	$19,039	$22,764	$27,548	14.1%	$51,046	13.1%
Total IC	$15,285	$18,549	$22,853	15.5%	$43,964	14.0%
Bipolar Digital (Tech)	$ 2,014	$ 2,388	$ 2,831	13.5%	$ 4,332	8.9%
TTL						
ECL						
Other						
Bipolar Digital (Func)	$ 2,014	$ 2,388	$ 2,831	13.5%	$ 4,332	8.9%
Memory	223	239	252	5.5%	283	2.3%
Logic	1,791	2,149	2,579	14.5%	4,049	9.4%
MOS (Technology)	$ 9,641	$12,139	$15,646	18.9%	$33,762	16.6%
NMOS						
PMOS						
CMOS						
MOS (Function)	$ 9,641	$12,139	$15,646	18.9%	$33,762	16.6%
Memory	3,268	3,915	5,301	18.3%	10,500	14.6%
Micro Device	2,855	3,897	5,066	21.4%	11,262	17.3%
Logic	3,518	4,327	5,279	17.3%	12,000	17.8%
Linear	$ 3,630	$ 4,022	$ 4,376	7.5%	$ 5,870	6.1%
Total Discrete	$ 2,739	$ 3,054	$ 3,335	7.3%	$ 4,463	6.0%
Total Optoelectronic	$ 1,015	$ 1,161	$ 1,360	12.3%	$ 2,619	14.0%

Source: Dataquest
May 1987

Semiconductor Consumption

Table 4a

JAPANESE SEMICONDUCTOR CONSUMPTION
(Billions of Yen)

	1978	1979	1980	1981	1982	1983
Total Semiconductor	¥514.1	¥606.2	¥768.1	¥949.1	¥1,012.3	¥1,328.0
Total IC	¥293.8	¥380.7	¥499.7	¥617.3	¥ 708.0	¥ 940.5
Bipolar Digital (Tech)	¥ 54.4	¥ 66.6	¥ 78.3	¥ 96.8	¥ 123.5	¥ 146.7
TTL	20.8	28.5	33.6	41.5	53.3	65.6
ECL	16.4	25.6	30.2	37.3	45.6	51.0
Other	17.2	12.5	14.5	18.0	24.6	30.1
Bipolar Digital (Func)	¥ 54.4	¥ 66.6	¥ 78.3	¥ 96.8	¥ 123.5	¥ 146.7
Memory		11.4	12.9	17.0	21.6	13.9
Logic		55.2	65.4	79.8	101.9	132.8
MOS (Tech)	¥123.5	¥166.9	¥225.0	¥259.5	¥ 313.2	¥ 451.2
NMOS	77.1	107.1	151.0	173.9	207.3	303.4
PMOS	35.9	23.9	19.5	16.9	14.1	13.6
CMOS	10.5	35.9	54.5	68.7	91.8	134.2
MOS (Func)	¥123.5	¥166.9	¥225.0	¥259.5	¥ 313.2	¥ 451.2
Memory		56.1	96.0	108.5	132.4	203.3
Micro Device		46.6	61.1	89.3	110.6	139.6
Logic		64.2	67.9	61.7	70.2	108.3
Linear	¥115.9	¥147.2	¥196.4	¥261.0	¥ 271.3	¥ 342.6
Total Discrete	¥198.6	¥194.7	¥223.8	¥273.3	¥ 240.5	¥ 297.8
Total Optoelectronic	¥ 21.7	¥ 30.8	¥ 44.6	¥ 58.5	¥ 63.8	¥ 89.7
Exchange Rate (Yen/US$)	210.0	219.0	227.0	221.0	248.0	235.0

Source: Dataquest
May 1987

Semiconductor Consumption

Table 4b

JAPANESE SEMICONDUCTOR CONSUMPTION
(Billions of Yen)

	1984	1985	1986	1987	1988	1989
Total Semiconductor	¥2,096.3	¥2,049.0	¥2,063.6	¥2,192.8	¥2,576.8	¥2,565.0
Total IC	¥1,589.2	¥1,563.0	¥1,584.8	¥1,714.6	¥2,039.6	¥2,033.7
Bipolar Digital (Tech)	¥ 236.8	¥ 226.9	¥ 216.8	¥ 231.3	¥ 276.1	¥ 277.7
TTL	111.4	104.2	117.9	99.9	116.3	113.2
ECL	83.2	85.0	61.0	96.7	120.6	126.3
Other	42.2	37.7	37.9	34.7	39.2	38.2
Bipolar Digital (Func)	¥ 236.8	¥ 226.9	¥ 216.8	¥ 231.3	¥ 276.1	¥ 277.7
Memory	31.3	29.8	26.1	29.7	34.2	33.6
Logic	205.5	197.1	190.7	201.6	241.9	244.1
MOS (Tech)	¥ 886.9	¥ 855.6	¥ 871.0	¥1,013.3	¥1,250.7	¥1,236.6
NMOS	571.9	539.1	502.8	517.9	544.1	444.0
PMOS	16.6	14.2	3.3	9.2	7.5	4.8
CMOS	298.4	302.3	364.9	486.2	699.0	787.9
MOS (Func)	¥ 886.9	¥ 855.6	¥ 871.0	¥1,013.3	¥1,250.7	¥1,236.6
Memory	404.1	322.0	288.7	351.7	460.8	434.3
Micro Device	216.4	222.8	257.3	295.8	361.3	361.9
Logic	266.4	310.8	325.0	365.8	428.6	440.4
Linear	¥ 465.5	¥ 480.5	¥ 497.0	¥ 470.0	¥ 512.8	¥ 519.4
Total Discrete	¥ 395.5	¥ 375.1	¥ 359.2	¥ 360.7	¥ 397.1	¥ 392.8
Total Optoelectronic	¥ 111.6	¥ 110.9	¥ 119.6	¥ 117.5	¥ 140.1	¥ 138.5
Exchange Rate (Yen/US$)	237.0	238.0	167.0	154.0	154.0	154.0

Source: Dataquest
May 1987

Semiconductor Consumption

Table 4c

JAPANESE SEMICONDUCTOR CONSUMPTION
(Billions of Yen)

	1990	1991	1992	CAGR (87-92)	1997	CAGR (92-97)
Total Semiconductor	¥2,932.0	¥3,505.7	¥4,242.6	14.1%	¥7,861.1	13.1%
Total IC	¥2,353.9	¥2,856.5	¥3,519.5	15.5%	¥6,770.4	14.0%
Bipolar Digital (Tech)	¥ 310.1	¥ 367.7	¥ 436.0	13.5%	¥ 667.1	8.9%
TTL	118.7	136.0	161.1	10.0%	200.0	4.4%
ECL	153.4	184.0	218.1	17.7%	413.6	13.7%
Other	38.0	47.7	56.8	10.4%	53.5	(1.2%)
Bipolar Digital (Func)	¥ 310.1	¥ 367.7	¥ 436.0	13.5%	¥ 667.1	8.9%
Memory	34.3	36.8	38.8	5.5%	43.6	2.4%
Logic	275.8	330.9	397.2	14.5%	623.5	9.4%
MOS (Tech)	¥1,484.8	¥1,869.4	¥2,409.6	18.9%	¥5,199.3	16.6%
NMOS	421.7	479.4	617.8	3.6%	831.9	6.1%
PMOS	4.5	4.2	5.6	(9.5%)	3.5	(9.0%)
CMOS	1,058.6	1,385.8	1,786.2	29.7%	4,363.9	19.6%
MOS (Func)	¥1,484.8	¥1,869.4	¥2,409.6	18.9%	¥5,199.3	16.6%
Memory	503.3	602.9	816.4	18.3%	1,617.0	14.6%
Micro Device	439.7	600.1	780.2	21.4%	1,734.3	17.3%
Logic	541.8	666.4	813.0	17.3%	1,848.0	17.8%
Linear	¥ 559.0	¥ 619.4	¥ 673.9	7.5%	¥ 904.0	6.1%
Total Discrete	¥ 421.9	¥ 470.4	¥ 513.7	7.3%	¥ 687.3	6.0%
Total Optoelectronic	156.2	178.8	209.4	12.3%	403.4	14.0%
Exchange Rate (Yen/US$)	154.0	154.0	154.0		154.0	

Source: Dataquest
May 1987

Semiconductor Consumption

Table 5a

WESTERN EUROPEAN SEMICONDUCTOR CONSUMPTION
(Millions of Dollars)

	1978	1979	1980	1981	1982	1983
Total Semiconductor	$2,339	$3,018	$3,686	$3,041	$3,167	$3,370
Total IC	$1,238	$1,747	$2,333	$1,892	$1,988	$2,323
Bipolar Digital (Tech)	$ 291	$ 390	$ 510	$ 454	$ 434	$ 483
TTL						
ECL						
Other						
Bipolar Digital (Func)	$ 291	$ 390	$ 510	$ 454	$ 434	$ 483
Memory		85	116	103	100	107
Logic		305	394	351	334	376
MOS (Technology)	$ 535	$ 781	$1,139	$ 882	$ 948	$1,227
NMOS						
PMOS						
CMOS						
MOS (Function)	$ 535	$ 781	$1,139	$ 882	$ 948	$1,227
Memory		367	543	426	469	581
Micro Device		125	189	149	168	239
Logic		289	407	307	311	407
Linear	$ 412	$ 576	$ 684	$ 556	$ 606	$ 613
Total Discrete	$1,004	$1,138	$1,192	$ 995	$1,011	$ 866
Total Optoelectronic	$ 97	$ 133	$ 161	$ 154	$ 168	$ 181

Source: Dataquest
May 1987

Semiconductor Consumption

Table 5b

WESTERN EUROPEAN SEMICONDUCTOR CONSUMPTION
(Millions of Dollars)

	1984	1985	1986	1987	1988	1989
Total Semiconductor	$4,805	$4,720	$5,532	$6,780	$8,129	$8,158
Total IC	$3,634	$3,556	$4,088	$5,126	$6,288	$6,415
Bipolar Digital (Tech)	$ 724	$ 709	$ 782	$ 978	$1,126	$1,075
TTL						
ECL						
Other						
Bipolar Digital (Func)	$ 724	$ 709	$ 782	$ 978	$1,126	$1,075
Memory	149	157	172	193	208	201
Logic	575	552	610	785	918	874
MOS (Technology)	$2,092	$1,953	$2,280	$2,942	$3,877	$4,035
NMOS						
PMOS						
CMOS						
MOS (Function)	$2,092	$1,953	$2,280	$2,942	$3,877	$4,035
Memory	995	750	822	1,043	1,385	1,420
Micro Device	465	485	578	726	936	1,005
Logic	632	718	880	1,173	1,556	1,610
Linear	$ 818	$ 894	$1,026	$1,206	$1,285	$1,305
Total Discrete	$ 963	$ 954	$1,153	$1,314	$1,450	$1,360
Total Optoelectronic	$ 208	$ 210	$ 291	$ 340	$ 391	$ 383

Source: Dataquest
May 1987

Semiconductor Consumption

Table 5c

WESTERN EUROPEAN SEMICONDUCTOR CONSUMPTION
(Millions of Dollars)

	1990	1991	1992	CAGR (87-92)	1997	CAGR (92-97)
Total Semiconductor	$9,192	$10,782	$12,900	13.7%	$24,145	13.4%
Total IC	$7,364	$ 8,878	$10,830	16.1%	$21,645	14.9%
Bipolar Digital (Tech)	$1,183	$ 1,321	$ 1,515	9.1%	$ 2,245	8.2%
TTL						
ECL						
Other						
Bipolar Digital (Func)	$1,183	$ 1,321	$ 1,515	9.1%	$ 2,245	8.2%
Memory	209	221	240	4.5%	270	2.4%
Logic	974	1,100	1,275	10.2%	1,975	9.1%
MOS (Technology)	$4,826	$ 6,074	$ 7,665	21.1%	$16,700	16.9%
NMOS						
PMOS						
CMOS						
MOS (Function)	$4,826	$ 6,074	$ 7,665	21.1%	$16,700	16.9%
Memory	1,685	2,132	2,740	21.3%	4,500	10.4%
Micro Device	1,253	1,718	2,250	25.4%	5,300	18.7%
Logic	1,888	2,224	2,675	17.9%	6,900	20.9%
Linear	$1,355	$ 1,483	$ 1,650	6.5%	$ 2,700	10.4%
Total Discrete	$1,420	$ 1,479	$ 1,600	4.0%	$ 1,800	2.4%
Total Optoelectronic	$ 408	$ 425	$ 470	6.7%	$ 700	8.3%

Source: Dataquest
May 1987

Semiconductor Consumption

Table 6a

REST OF WORLD SEMICONDUCTOR CONSUMPTION
(Millions of Dollars)

	1978	1979	1980	1981	1982	1983
Total Semiconductor	$660	$790	$996	$963	$1,042	$1,503
Total IC	$258	$364	$450	$494	$ 585	$ 959
Bipolar Digital (Tech)	$ 45	$ 79	$108	$106	$ 113	$ 162
TTL						
ECL						
Other						
Bipolar Digital (Func)	$ 45	$ 79	$108	$106	$ 113	$ 162
Memory		2	3	3	4	4
Logic		77	105	103	109	158
MOS (Technology)	$110	$100	$143	$171	$ 248	$ 450
NMOS						
PMOS						
CMOS						
MOS (Function)	$110	$100	$143	$171	$ 248	$ 450
Memory		25	34	51	106	194
Micro Device		17	27	43	63	112
Logic		58	82	77	79	144
Linear	$103	$185	$199	$217	$ 224	$ 347
Total Discrete	$346	$334	$416	$355	$ 345	$ 419
Total Optoelectronic	$ 56	$ 92	$130	$114	$ 112	$ 125

Source: Dataquest
May 1987

Semiconductor Consumption

Table 6b

REST OF WORLD SEMICONDUCTOR CONSUMPTION
(Millions of Dollars)

	1984	1985	1986	1987	1988	1989
Total Semiconductor	$2,298	$1,897	$2,920	$3,905	$5,074	$5,168
Total IC	$1,474	$1,155	$1,887	$2,678	$3,594	$3,707
Bipolar Digital (Tech)	$ 246	$ 131	$ 220	$ 297	$ 376	$ 382
TTL						
ECL						
Other						
Bipolar Digital (Func)	$ 246	$ 131	$ 220	$ 297	$ 376	$ 382
Memory	7	6	12	15	21	22
Logic	239	125	208	282	355	360
MOS (Technology)	$ 825	$ 627	$1,084	$1,638	$2,268	$2,365
NMOS						
PMOS						
CMOS						
MOS (Function)	$ 825	$ 627	$1,084	$1,638	$2,268	$2,365
Memory	313	136	227	379	552	580
Micro Device	164	135	280	424	570	605
Logic	348	356	577	835	1,146	1,180
Linear	$ 403	$ 397	$ 583	$ 743	$ 950	$ 960
Total Discrete	$ 695	$ 622	$ 866	$1,031	$1,239	$1,225
Total Optoelectronic	$ 129	$ 120	$ 167	$ 196	$ 241	$ 236

Source: Dataquest
May 1987

Semiconductor Consumption

Table 6c

REST OF WORLD SEMICONDUCTOR CONSUMPTION
(Millions of Dollars)

	1990	1991	1992	CAGR (87-92)	1997	CAGR (92-97)
Total Semiconductor	$5,937	$7,034	$8,628	17.2%	$19,158	17.3%
Total IC	$4,354	$5,280	$6,652	20.0%	$16,108	19.3%
Bipolar Digital (Tech)	$ 429	$ 504	$ 616	15.7%	$ 1,208	14.4%
TTL						
ECL						
Other						
Bipolar Digital (Func)	$ 429	$ 504	$ 616	15.7%	$ 1,208	14.4%
Memory	25	30	37	19.8%	58	9.3%
Logic	404	474	579	15.5%	1,150	14.7%
MOS (Technology)	$2,845	$3,542	$4,580	22.8%	$12,300	21.8%
NMOS						
PMOS						
CMOS						
MOS (Function)	$2,845	$3,542	$4,580	22.8%	$12,300	21.8%
Memory	700	882	1,150	24.9%	3,400	24.2%
Micro Device	725	910	1,180	22.7%	3,100	21.3%
Logic	1,420	1,750	2,250	21.9%	5,800	20.9%
Linear	$1,080	$1,234	$1,456	14.4%	$ 2,600	12.3%
Total Discrete	$1,325	$1,465	$1,640	9.7%	$ 2,500	8.8%
Total Optoelectronic	$ 258	$ 289	$ 336	11.4%	$ 550	10.4%

Source: Dataquest
May 1987

Semiconductor Consumption

Table 7a

WORLDWIDE AVERAGE SELLING PRICES
(Dollars)

	1978	1979	1980	1981	1982	1983
Total Semiconductor	$0.29	$0.30	$0.32	$0.31	$0.33	$0.33
Total IC	$1.01	$0.97	$1.07	$1.02	$1.01	$1.04
Bipolar Digital (Tech)	$0.63	$0.57	$0.70	$0.70	$0.62	$0.65
TTL						
ECL						
Other						
Bipolar Digital (Func)	$0.63	$0.57	$0.70	$0.70	$0.62	$0.65
Memory						3.24
Logic						.54
MOS (Technology)	$1.91	$1.93	$1.81	$1.66	$1.71	$1.72
NMOS	$4.46	$3.66	$3.08	$3.06	$2.91	$3.15
PMOS	$1.92	$1.80	$1.75	$1.70	$1.70	$1.75
CMOS	$0.64	$0.78	$0.79	$0.74	$0.78	$0.80
MOS (Function)	$1.91	$1.93	$1.81	$1.66	$1.71	$1.72
Memory		$5.15	$4.90	$3.17	$3.06	$3.21
Micro Device		$3.96	$3.61	$3.40	$3.34	$3.40
Logic		$0.89	$0.85	$0.86	$0.80	$0.79
Linear	$0.84	$0.78	$0.83	$0.81	$0.79	$0.76
Total Discrete	$0.13	$0.12	$0.12	$0.11	$0.11	$0.09
Total Optoelectronic	$0.47	$0.51	$0.44	$0.39	$0.38	$0.37

Source: Dataquest
May 1987

Semiconductor Consumption

Table 7b

WORLDWIDE AVERAGE SELLING PRICES
(Dollars)

	1984	1985	1986	1987	1988	1989
Total Semiconductor	$0.36	$0.34	$0.35	$0.39	$0.41	$0.37
Total IC	$1.11	$1.07	$1.12	$1.18	$1.26	$1.24
Bipolar Digital (Tech)	$0.65	$0.71	$0.71	$0.73	$0.75	$0.75
TTL						
ECL						
Other						
Bipolar Digital (Func)	$0.65	$0.71	$0.71	$0.73	$0.75	$0.75
Memory			4.26			
Logic			.62			
MOS (Technology)	$2.02	$1.68	$1.74	$1.81	$1.92	$1.88
NMOS	$3.73	$2.54	$2.60	$2.67	$2.56	$2.33
PMOS	$1.75	$1.75	$1.70	$1.70	$1.65	$1.65
CMOS	$0.99	$1.07	$1.22	$1.37	$1.63	$1.73
MOS (Function)	$2.02	$1.68	$1.74	$1.81	$1.92	$1.88
Memory	$3.90	$2.59	$2.40	$2.73	$3.14	$2.86
Micro Device	$4.41	$3.91	$4.10	$4.16	$4.51	$3.93
Logic	$0.85	$0.93	$1.05	$1.08	$1.10	$1.14
Linear	$0.75	$0.76	$0.84	$0.84	$0.88	$0.86
Total Discrete	$0.09	$0.09	$0.09	$0.10	$0.10	$0.08
Total Optoelectronic	$0.36	$0.33	$0.32	$0.34	$0.35	$0.32

Source: Dataquest
May 1987

Semiconductor Consumption

Table 7c

WORLDWIDE AVERAGE SELLING PRICES
(Dollars)

	1990	1991	1992	CAGR (87-92)	1997	CAGR (92-97)
Total Semiconductor	$0.39	$0.39	$0.43	2.0%	$0.56	5.6%
Total IC	$1.31	$1.40	$1.43	4.0%	$1.73	3.8%
Bipolar Digital (Tech)	$0.77	$0.81	$0.82	2.4%	$0.86	1.0%
TTL						
ECL						
Other						
Bipolar Digital (Func)	$0.77	$0.81	$0.92	4.7%	$0.86	(1.3%)
Memory						
Logic						
MOS (Technology)	$1.98	$2.10	$2.07	2.7%	$2.54	4.1%
NMOS	$2.28	$2.24	$1.84	(7.1%)	$1.08	(10.1%)
PMOS	$1.65	$1.65	$1.60	(1.2%)	$1.30	(4.1%)
CMOS	$1.91	$2.08	$2.10	8.9%	$2.57	4.1%
MOS (Function)	$1.98	$2.10	$2.07	2.7%	$2.54	4.1%
Memory	$3.18	$3.52	$3.80	6.8%	$3.80	0.0%
Micro Device	$3.76	$3.64	$3.80	(1.8%)	$3.80	0.0%
Logic	$1.21	$1.28	$1.40	5.3%	$1.70	4.0%
Linear	$0.88	$0.92	$0.94	2.3%	$0.95	0.2%
Total Discrete	$0.08	$0.08	$0.08	(4.8%)	$0.08	(0.1%)
Total Optoelectronic	$0.33	$0.33	$0.34	(0.4%)	$0.32	(1.0%)

Source: Dataquest
May 1987

Semiconductor Consumption

Table 8a

WORLDWIDE SEMICONDUCTOR CONSUMPTION
(Millions of Units)

	1978	1979	1980	1981	1982	1983
Total Semiconductor	30,986	37,421	43,800	47,180	46,264	60,344
Total IC	5,171	7,242	8,955	9,809	10,791	14,110
Bipolar Digital (Tech)	2,002	2,937	3,391	3,339	3,890	4,612
TTL						
ECL						
Other						
Bipolar Digital (Func)	2,002	2,937	3,391	3,339	3,890	4,612
Memory						183
Logic						4429
MOS (Technology)	1,221	1,731	2,603	2,906	3,306	4,665
NMOS	305	597	1,041	1,042	1,341	1,745
PMOS	299	276	287	265	221	182
CMOS	617	858	1,275	1,598	1,744	2,738
MOS (Function)	1,221	1,731	2,603	2,906	3,306	4,665
Memory		325	455	655	883	1,150
Micro Device		137	239	319	395	592
Logic		1,269	1,909	1,933	2,029	2,923
Linear	1,949	2,574	2,960	3,564	3,595	4,833
Total Discrete	24,917	29,068	33,288	35,326	33,314	43,443
Total Optoelectronic	898	1,111	1,557	2,045	2,159	2,791

Source: Dataquest
May 1987

Semiconductor Consumption

Table 8b

WORLDWIDE SEMICONDUCTOR CONSUMPTION
(Millions of Units)

	1984	1985	1986	1987	1988	1989
Total Semiconductor	80,601	73,191	88,996	94,977	106,818	118,656
Total IC	20,425	17,809	21,010	24,092	27,829	28,344
Bipolar Digital (Tech)	7,403	5,351	6,086	6,799	8,056	7,933
TTL						
ECL						
Other						
Bipolar Digital (Func)	7,403	5,351	6,086	6,799	8,056	7,933
Memory			158			
Logic			5928			
MOS (Technology)	6,453	6,186	7,524	9,199	11,034	11,416
NMOS	2,376	2,558	2,800	3,123	3,486	2,958
PMOS	161	83	66	59	50	41
CMOS	3,917	3,545	4,659	6,016	7,498	8,417
MOS (Function)	6,453	6,186	7,524	9,199	11,034	11,416
Memory	1,605	1,549	1,808	2,011	2,275	2,451
Micro Device	739	704	893	1,115	1,302	1,536
Logic	4,108	3,933	4,824	6,073	7,458	7,430
Linear	6,569	6,272	7,400	8,094	8,739	8,994
Total Discrete	56,660	51,883	63,040	65,812	73,025	83,927
Total Optoelectronic	3,516	3,499	4,946	5,073	5,963	6,385

Source: Dataquest
May 1987

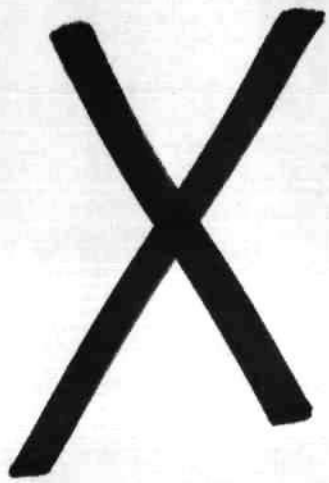
Semiconductor Consumption

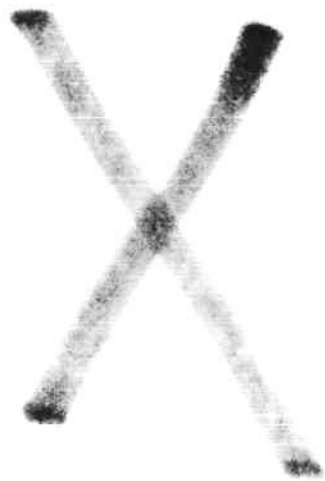
Table 8c

WORLDWIDE SEMICONDUCTOR CONSUMPTION
(Millions of Units)

	1990	1991	1992	CAGR (87-92)	1997	CAGR (92-97)
Total Semiconductor	127,585	149,422	165,538	11.8%	235,640	7.3%
Total IC	30,915	34,355	40,968	11.2%	66,881	10.3%
Bipolar Digital (Tech)	8,499	9,319	10,868	9.8%	17,017	9.4%
TTL						
ECL						
Other						
Bipolar Digital (Func)	8,499	9,319	9,687	7.3%	17,017	11.9%
Memory						
Logic						
MOS (Technology)	12,875	14,943	19,083	15.7%	33,790	12.1%
NMOS	2,461	1,961	2,143	(7.3%)	791	(18.1%)
PMOS	38	35	31	(12.1%)	1	(49.8%)
CMOS	10,376	12,947	16,909	23.0%	32,998	14.3%
MOS (Function)	12,875	14,943	19,083	15.7%	33,790	12.1%
Memory	2,548	2,764	3,750	13.3%	6,421	11.4%
Micro Device	1,917	2,569	3,447	25.3%	7,016	15.3%
Logic	8,410	9,610	11,886	14.4%	20,353	11.4%
Linear	9,541	10,093	11,017	6.4%	16,074	7.8%
Total Discrete	89,903	107,688	116,171	12.0%	153,768	5.8%
Total Optoelectronic	6,767	7,379	8,398	10.6%	14,990	12.3%

Source: Dataquest
May 1987





Semiconductor Consumption

INTRODUCTION

Semiconductor consumption data comprise a set of detailed tables that estimate the size of the semiconductor total available market (TAM) worldwide and for four major geographical regions for the years 1976 through 1992 and 1997. Semiconductor consumption tables contain both historical data and forecasts. Historical data begin with 1978 and end with 1987, while forecast data provide annual market size estimates for 1988 through 1992, with additional estimates for 1997. Below is a list of tables detailing the type of data, region, time period, and units of measure.

LIST OF TABLES

Table	Region Covered	Years	Units
0	Japan and Western Europe Exchange Rates	1987	Various
1a	Worldwide Consumption	1976-1981	Dollars
1b	Worldwide Consumption	1982-1987	Dollars
1c	Worldwide Consumption	1988-1992; 1997	Dollars
1d	Worldwide Consumption (CAGR)	1977-1997	Percent
2a	North American Consumption	1976-1981	Dollars
2b	North American Consumption	1982-1987	Dollars
2c	North American Consumption	1988-1992; 1997	Dollars
2d	North American Consumption	1977-1997	Percent
3a	Japanese Consumption	1976-1981	Dollars
3b	Japanese Consumption	1982-1987	Dollars
3c	Japanese Consumption	1988-1992; 1997	Dollars
3d	Japanese Consumption	1977-1997	Percent
4a	Japanese Consumption	1976-1981	Yen
4b	Japanese Consumption	1982-1987	Yen
4c	Japanese Consumption	1988-1992; 1997	Yen
4d	Japanese Consumption	1977-1997	Percent
5a	Western European Consumption	1976-1981	Dollars
5b	Western European Consumption	1982-1987	Dollars
5c	Western European Consumption	1988-1992; 1997	Dollars
5d	Western European Consumption	1977-1997	Percent
6a	Rest of World Consumption	1976-1981	Dollars
6b	Rest of World Consumption	1982-1987	Dollars
6c	Rest of World Consumption	1988-1992; 1997	Dollars
6d	Rest of World Consumption	1977-1997	Percent
7a	Worldwide Average Selling Prices	1976-1981	Dollars
7b	Worldwide Average Selling Prices	1982-1987	Dollars
7c	Worldwide Average Selling Prices	1988-1992; 1997	Dollars
7d	Worldwide Average Selling Prices	1977-1997	Percent
8a	Worldwide Consumption	1976-1981	Units
8b	Worldwide Consumption	1982-1987	Units
8c	Worldwide Consumption	1988-1992; 1997	Units
8d	Worldwide Consumption	1977-1997	Percent

Semiconductor Consumption

Each table gives estimates of semiconductor consumption listed by the major semiconductor device product categories. In these tables, semiconductor components are divided into three major product groups: integrated circuits, discrete devices, and optoelectronic devices. These groups are divided into a number of subgroups, some of which are segmented further.

DEFINITIONS AND CONVENTIONS

Dataquest uses a common manufacturer base for all data tables. This base includes all suppliers to the merchant semiconductor market. It excludes captive suppliers that manufacture devices solely for the benefit of the parent company, such as AT&T, Burroughs, Delco, and IBM. Included, however, are companies that actively market semiconductor devices to the merchant market as well as to other divisions of their own companies. For such companies, both external shipments and internal consumption are included. Devices that are used internally are valued at current market prices.

Consumption—Dataquest defines consumption as the purchase of a semiconductor device or devices. This definition must be differentiated from actual use of the device in a final product. Devices that are inventoried at the user level are considered consumption according to our definition. The terms consumption and market size are used interchangeably. Thus, a regional market includes all devices sold to or shipped to that region, i.e. the total available market (TAM) in that region.

Hybrids—In earlier consumption data, hybrid devices were included as a separate segment of integrated circuits. However, since hybrid devices are primarily a special packaging arrangement, this segment has been omitted. Hybrid devices manufactured by semiconductor companies are now included in the most appropriate product segment, usually the linear segment.

The manufacturer base product group definitions and guidelines for including value of output that we have used in our tables may differ from those used in other studies of this type. Our base is nearly the same as that used by the World Semiconductor Trade Statistics program (WSTS).

Regions—North America is defined as including both the United States and Canada. Latin America, including Mexico, is considered part of the Rest of World (ROW) category. Western Europe includes Austria, Belgium, the Federal Republic of Germany, France, Greece, Italy, Luxembourg, the Scandinavian countries (Denmark, Finland, Norway, Sweden), Spain, and the United Kingdom. The ROW region includes the Asia-Pacific (Korea, Taiwan, Hong Kong, Singapore, and China).

Semiconductor Consumption

DATA SOURCES

The information presented in the consumption data has been consolidated from a variety of sources, each of which focuses on a specific part of the market. These sources include the following:

- World Semiconductor Trade Statistics (WSTS) data, and Dataquest's estimates of regional company sales are used to determine North American consumption.
- Japanese trade statistics compiled and published by the Ministry of Finance (MOF) and the Ministry of International Trade and Industry (MITI), WSTS data, and Dataquest's estimates of regional company sales are used to determine Japanese consumption.
- For Western European markets, marketing statistics from WSTS data and Dataquest's estimates of regional company sales are used to determine consumption.
- In ROW, the major published sources used to estimate consumption are WSTS data and Dataquest's estimates of company shipments into the region.

Dataquest believes that the estimates presented here are the most accurate and meaningful generally available today. The sources of the data and the guidelines for the forecasts presented in the tables are:

- Unit sales or revenue (or both) published by major industry participants, both in the United States and abroad
- Estimates presented by knowledgeable and reliable industry spokesmen
- Government data or trade association data such as those from the Electronics Industry Association (EIA), MITI, WSTS, and the U.S. Department of Commerce
- Published product literature and price lists
- Interviews with knowledgeable manufacturers, distributors, and users
- Relevant projected world economic data

CONSISTENCY

One of the key objectives in preparing these estimates is to achieve consistency among the various data elements that constitute the forecast and the historical data base. To ensure the accuracy and consistency of the estimates, we have compared the values of directly obtained data elements with values obtained by indirect means, wherever possible. Thus, the worldwide totals in the consumption analysis are consistent with the worldwide totals of the market share analysis.

Semiconductor Consumption

ACCURACY

The tables presented here represent Dataquest estimates that we believe are reasonably accurate. Where we have no reasonable estimate, none is given. A blank space in a table indicates that a reasonably accurate estimate is unavailable, and a zero in a table represents an estimate.

VALUATION OF CONSUMPTION

Regional consumption is expressed in U.S. dollars (with Japanese consumption and shipments also expressed in yen). To make the tables in this study useful in comparing different regions, it is necessary to express all values in a common currency, and we chose the U.S. dollar for convenience.

However, the choice of the U.S. dollar (or any single currency, for that matter) as the currency basis for the tables brings with it some problems that require the readers' careful consideration in interpreting the data.

Inflation

All countries that participate significantly in international semiconductor markets suffered from an overall price inflation in the 1970s, continuing into the 1980s.

As a consequence, the dollar in a given year is not truly comparable with the dollar in any preceding year. Consumer and wholesale price indices and GNP deflators all measure price changes in various composite "market baskets" of goods. However, there is no price index that measures price changes of material, equipment, and labor inputs to the semiconductor industry. Indeed, the "mix" is changing so rapidly that what is used this year was sometimes unavailable last year, at any price. Nor is there a composite price index that measures price changes in aggregate semiconductor product. In an industry noted for its deflationary trends, this latter effect would tend to make the component purchaser's dollar worth more as time passed, in terms of purchasing ability.

We have made no adjustments in the historical data to account for these inflationary and deflationary effects. The data are expressed in current dollars (dollars that include the inflation rate and exchange rates of the given year) for all historical data; comparisons between different years must be interpreted accordingly.

Average Selling Prices

When considering the worldwide average selling prices (ASPs) for semiconductor components, one must look at the price per function of a circuit, the complexity of the circuit, and the product mix according to this increasing complexity. It is true that one characteristic of the semiconductor industry is that the price per function for integrated circuits has been dropping an average of 30 percent per year for the last 15 years. At

the same time, circuits have become denser, resulting in an overall increase in the price of a device with a decreasing cost per function. Thus, Table 7 shows the worldwide ASPs increasing after many years of decreasing, due to the move toward higher-complexity devices. There are also regional differences in ASPs due to regional competition differences and the varying regional product consumption mix. The worldwide ASP is truly an aggregate measure and may differ significantly from ASPs in any specific market at any point in time.

Exchange Rates

Construction of the West European tables involves combining data from many countries, each of which has different and changing exchange rates. Dataquest uses Annual Foreign Exchange Rates for each year as published by The International Monetary Fund. As far as possible, we prepare our estimates in terms of local currencies before conversion to U.S. dollars. The exchange rates for major currencies can be found in Table 0 at the end of this introduction.

Japanese consumption is based on MITI data, originally expressed in yen. The Japanese data published in this study are expressed in both dollars (Tables 3a, 3b, and 3c) and in yen (Tables 4a, 4b, and 4c). The yen/dollar exchange rate used for each year can be found in Table 0. Because of the fluctuations in the exchange rate for the yen, the dollar values given tend to distort the growth rate of the Japanese market, but they do provide a useful basis for regional market size comparisons. However, the data in yen give a better picture of the real growth in the Japanese market.

FORECAST

As mentioned previously, historical data are expressed in current dollars or dollars that include the given year's inflation rate and exchange rates. However, the consumption forecasts use constant dollars and exchange rates, with no allowance for inflation or variations in the rates of exchange between countries. All estimates for 1988 and beyond are made as if 1988 monetary conditions will continue through 1997 and, therefore, show the absolute year-to-year growth during this period.

Semiconductor Consumption

Table 0

Foreign Exchange Rates
(In U.S. Dollars)

Year	Yrly/ Qtrly	Japan (Yen per US$)	France (US$ per Franc)	West Germany (US$ per Deutsche Mark)	United Kingdom (US$ per Pound Sterling)	European Basket ECU (1980 = 100)
						per US $
1970	YR	358	$0.18	$0.27	$2.38	
1971	YR	343	$0.18	$0.29	$2.44	
1972	YR	302	$0.20	$0.31	$2.50	
1973	YR	269	$0.22	$0.37	$2.44	
1974	YR	292	$0.21	$0.39	$2.33	
1975	YR	297	$0.23	$0.41	$2.22	
1976	YR	296	$0.21	$0.40	$1.82	
1977	YR	269	$0.20	$0.43	$1.75	
1978	YR	210	$0.22	$0.50	$1.92	
1979	YR	219	$0.24	$0.55	$2.13	
1980	YR	227	$0.24	$0.55	$2.33	100
1981	YR	221	$0.18	$0.44	$2.04	124
1982	YR	248	$0.15	$0.41	$1.75	141
1983	YR	235	$0.13	$0.39	$1.52	158
1984	YR	237	$0.11	$0.35	$1.33	178
1985	YR	238	$0.11	$0.34	$1.30	185
1986	YR	167	$0.14	$0.46	$1.47	146
1987	YR	144	$0.17	$0.56	$1.64	126
1988	Q1	130	$0.18	$0.60	$1.79	~~127~~ 1.184 x '80 value

Source: The International Monetary Fund
Dataquest
June 1988

Semiconductor Consumption

Table 1a

Worldwide Semiconductor Market
(Millions of Dollars)

	1976	1977	1978	1979	1980	1981
Total Semiconductor	$5,982	$6,968	$8,953	$11,114	$14,118	$14,828
Total IC	$3,087	$3,763	$5,230	$ 7,028	$ 9,546	$10,046
Bipolar Digital	$ 865	$ 994	$1,261	$ 1,674	$ 2,374	$ 2,337
Memory				324	572	558
Logic				1,350	1,802	1,779
MOS Digital	$1,239	$1,584	$2,332	$ 3,346	$ 4,715	$ 4,822
Memory				1,676	2,230	2,075
Micro				541	862	1,085
Logic				1,129	1,623	1,662
Linear	$ 983	$1,185	$1,637	$ 2,008	$ 2,457	$ 2,887
Total Discrete	$2,612	$2,903	$3,301	$ 3,522	$ 3,883	$ 3,985
Total Optoelectronic	$ 283	$ 302	$ 422	$ 564	$ 689	$ 797

Source: Dataquest
June 1988

Semiconductor Consumption

Table 1b

Worldwide Semiconductor Market
(Millions of Dollars)

	1982	1983	1984	1985	1986	1987
Total Semiconductor	$15,261	$19,537	$28,903	$24,357	$29,670	$36,498
Total IC	$10,894	$14,700	$22,686	$18,555	$22,848	$28,668
Bipolar Digital	$ 2,412	$ 3,015	$ 4,771	$ 3,672	$ 4,309	$ 4,672
Memory	511	603	774	589	599	565
Logic	1,901	2,412	3,997	3,083	3,710	4,107
MOS Digital	$ 5,642	$ 7,951	$12,970	$10,122	$12,503	$16,788
Memory	2,701	3,719	6,229	3,821	4,652	6,019
Micro	1,318	1,979	3,234	2,748	3,478	4,819
Logic	1,623	2,253	3,507	3,553	4,373	5,950
Linear	$ 2,840	$ 3,734	$ 4,945	$ 4,761	$ 6,036	$ 7,208
Total Discrete	$ 3,547	$ 3,865	$ 4,987	$ 4,576	$ 5,222	$ 6,112
Total Optoelectronic	$ 820	$ 972	$ 1,230	$ 1,226	$ 1,600	$ 1,718

Source: Dataquest
June 1988

Semiconductor Consumption

Table 1c

Worldwide Semiconductor Market
(Millions of Dollars)

	1988	1989	1990	1991	1992	1997
Total Semiconductor	$46,048	$50,194	$49,446	$57,152	$69,533	$120,770
Total IC	$36,806	$40,401	$39,572	$46,253	$57,203	$103,760
Bipolar Digital	$ 5,531	$ 5,901	$ 5,731	$ 6,492	$ 7,572	$ 10,760
Memory	621	636	613	578	534	310
Logic	4,910	5,265	5,118	5,914	7,038	10,450
MOS Digital	$22,621	$25,073	$24,291	$28,621	$36,179	$ 70,000
Memory	8,528	9,583	8,967	10,327	~~12,615~~	25,000
Micro	6,154	6,743	6,603	7,742	~~12,029~~	18,000
Logic	7,939	8,747	8,721	10,552	~~16,281~~	27,000
Linear	$ 8,654	$ 9,427	$ 9,550	$11,140	$13,452	$ 23,000
Total Discrete	$ 7,185	$ 7,573	$ 7,613	$ 8,339	$ 9,341	$ 12,400
Total Optoelectronic	$ 2,057	$ 2,220	$ 2,261	$ 2,560	$ 2,989	$ 4,610

Source: Dataquest
June 1988

Semiconductor Consumption

Table 1d

Worldwide Semiconductor Market
(Compound Annual Growth Rates)

	CAGR (77-82)	CAGR (82-87)	CAGR (87-92)	CAGR (92-97)	CAGR (77-87)	CAGR (87-97)
Total Semiconductor	17.0%	19.1%	13.8%	11.7%	18.0%	12.7%
Total IC	23.7%	21.4%	14.8%	12.6%	22.5%	13.7%
Bipolar Digital	19.4%	14.1%	10.1%	7.3%	16.7%	8.7%
Memory	N/A	2.0%	(1.1%)	(10.3%)	N/A	(5.8%)
Logic	N/A	16.7%	11.4%	8.2%	N/A	9.8%
MOS Digital	28.9%	24.4%	16.6%	14.1%	26.6%	15.3%
Memory	N/A	17.4%	16.0%	14.7%	N/A	15.3%
Micro	N/A	29.6%	20.1%	~~8.4%~~ 13.9%	N/A	14.1%
Logic	N/A	29.7%	22.3%	10.6%	N/A	16.3%
Linear	19.1%	20.5%	13.3%	11.3%	19.8%	12.3%
Total Discrete	4.1%	11.5%	6.7%	5.8%	7.7%	7.3%
Total Optoelectronic	22.1%	15.9%	11.7%	9.1%	19.0%	10.4%

Source: Dataquest
June 1988

Semiconductor Consumption

Table 2a

North American Semiconductor Market
(Millions of Dollars)

	1976	1977	1978	1979	1980	1981
Total Semiconductor	$2,423	$2,876	$3,506	$4,538	$6,053	$6,529
Total IC	$1,490	$1,811	$2,335	$3,179	$4,562	$4,867
Bipolar Digital	$ 470	$ 537	$ 666	$ 901	$1,411	$1,339
Memory				185	396	375
Logic				716	1,015	964
MOS Digital	$ 640	$ 830	$1,099	$1,703	$2,442	$2,595
Memory				1,028	1,230	1,107
Micro				186	377	489
Logic				489	835	999
Linear	$ 380	$ 444	$ 570	$ 575	$ 709	$ 933
Total Discrete	$ 789	$ 940	$1,005	$1,161	$1,269	$1,378
Total Optoelectronic	$ 144	$ 125	$ 166	$ 198	$ 222	$ 284

Source: Dataquest
June 1988

Semiconductor Consumption

Table 2b

North American Semiconductor Market
(Millions of Dollars)

	1982	1983	1984	1985	1986	1987
Total Semiconductor	$6,970	$9,002	$13,006	$9,420	$9,968	$11,869
Total IC	$5,466	$7,301	$11,089	$7,757	$8,202	$ 9,991
Bipolar Digital	$1,367	$1,664	$ 2,818	$1,926	$1,990	$ 2,072
Memory	320	373	441	288	292	279
Logic	1,047	1,291	2,377	1,638	1,698	1,793
MOS Digital	$3,183	$4,326	$ 6,503	$4,322	$4,538	$ 6,128
Memory	1,592	2,051	3,426	1,753	1,831	2,347
Micro	641	1,034	1,634	1,258	1,285	1,817
Logic	950	1,241	1,443	1,311	1,422	1,964
Linear	$ 916	$1,311	$ 1,768	$1,509	$1,674	$ 1,791
Total Discrete	$1,201	$1,353	$ 1,503	$1,295	$1,352	$ 1,442
Total Optoelectronic	$ 303	$ 348	$ 414	$ 368	$ 414	$ 436

Source: Dataquest
June 1988

Semiconductor Consumption

Table 2c

North American Semiconductor Market
(Millions of Dollars)

	1988	1989	1990	1991	1992	1997
Total Semiconductor	$14,720	$15,576	$15,236	$17,993	$22,355	$37,010
Total IC	$12,682	$13,494	$13,079	$15,655	$19,762	$33,650
Bipolar Digital	$ 2,269	$ 2,375	$ 2,245	$ 2,528	$ 2,924	$ 3,750
Memory	297	301	291	275	265	150
Logic	1,972	2,074	1,954	2,253	2,659	3,600
MOS Digital	$ 8,424	$ 9,038	$ 8,664	$10,582	$13,794	$25,000
Memory	3,485	3,721	3,499	4,287	5,936	9,800
Micro	2,349	2,500	2,375	2,890	3,558	6,800
Logic	2,590	2,817	2,790	3,405	4,300	8,400
Linear	$ 1,989	$ 2,081	$ 2,170	$ 2,545	$ 3,044	$ 4,900
Total Discrete	$ 1,573	$ 1,587	$ 1,642	$ 1,753	$ 1,904	$ 2,400
Total Optoelectronic	$ 465	$ 495	$ 515	$ 585	$ 689	$ 960

Source: Dataquest
June 1988

Table 2d

North American Semiconductor Market (Compound Annual Growth Rates)

	CAGR (77-82)	CAGR (82-87)	CAGR (87-92)	CAGR (92-97)	CAGR (77-87)	CAGR (87-97)
Total Semiconductor	19.4%	11.2%	13.5%	10.6%	15.2%	12.0%
Total IC	24.7%	12.8%	14.6%	11.2%	18.6%	12.9%
Bipolar Digital	20.5%	8.7%	7.1%	5.1%	14.5%	6.1%
Memory	N/A	(2.7%)	(1.0%)	(10.8%)	N/A	(6.0%)
Logic	N/A	11.4%	8.2%	6.2%	N/A	7.2%
MOS Digital	30.8%	14.0%	17.6%	12.6%	22.1%	15.1%
Memory	N/A	8.1%	20.4%	10.5%	N/A	15.4%
Micro	N/A	23.2%	14.4%	13.8%	N/A	14.1%
Logic	N/A	15.6%	17.0%	14.3%	N/A	15.6%
Linear	15.6%	14.4%	11.2%	10.0%	15.0%	10.6%
Total Discrete	5.0%	3.7%	5.8%	4.7%	4.4%	5.2%
Total Optoelectronic	19.4%	7.5%	8.2%	6.9%	13.3%	8.2%

Source: Dataquest
June 1988

Semiconductor Consumption

Table 3a

Japanese Semiconductor Market
(Millions of Dollars)

	1976	1977	1978	1979	1980	1981
Total Semiconductor	$1,632	$1,723	$2,448	$2,768	$3,383	$4,295
Total IC	$ 787	$ 864	$1,399	$1,738	$2,201	$2,793
Bipolar Digital	$ 174	$ 190	$ 259	$ 304	$ 345	$ 438
Memory				52	57	77
Logic				252	288	361
MOS Digital	$ 306	$ 314	$ 588	$ 762	$ 991	$1,174
Memory				256	423	491
Micro				213	269	404
Logic				293	299	279
Linear	$ 307	$ 360	$ 552	$ 672	$ 865	$1,181
Total Discrete	$ 801	$ 792	$ 946	$ 889	$ 986	$1,237
Total Optoelectronic	$ 44	$ 67	$ 103	$ 141	$ 196	$ 265

Source: Dataquest
June 1988

Semiconductor Consumption

Table 3b

Japanese Semiconductor Market
(Millions of Dollars)

	1982	1983	1984	1985	1986	1987
Total Semiconductor	$4,082	$5,722	$8,774	$8,149	$11,852	$14,329
Total IC	$2,855	$4,167	$6,517	$5,985	$ 8,879	$11,006
Bipolar Digital	$ 498	$ 706	$ 955	$ 824	$ 1,328	$ 1,491
Memory	87	109	163	136	170	183
Logic	411	597	792	688	1,158	1,308
MOS Digital	$1,263	$1,948	$3,621	$3,232	$ 4,798	$ 6,327
Memory	534	893	1,579	1,185	1,755	2,311
Micro	446	594	979	884	1,371	1,732
Logic	283	461	1,063	1,163	1,672	2,284
Linear	$1,094	$1,513	$1,941	$1,929	$ 2,753	$ 3,188
Total Discrete	$ 970	$1,217	$1,756	$ 1,621	$ 2,164	$ 2,424
Total Optoelectronic	$ 257	$ 338	$ 501	$ 543	$ 809	$ 899

Source: Dataquest
June 1988

Semiconductor Consumption

Table 3c

Japanese Semiconductor Market
(Millions of Dollars)

	1988	1989	1990	1991	1992	1997
Total Semiconductor	$18,217	$19,845	$18,788	$21,071	$25,404	$45,300
Total IC	$14,062	$15,359	$14,487	$16,261	$19,844	$37,300
Bipolar Digital	$ 1,919	$ 2,056	$ 1,963	$ 2,230	$ 2,620	$ 4,300
Memory	215	223	213	200	170	100
Logic	1,704	1,833	1,750	2,030	2,450	4,200
MOS Digital	$ 8,296	$ 9,105	$ 8,469	$ 9,408	$11,676	$24,000
Memory	3,047	3,421	2,989	3,088	4,027	8,000
Micro	2,114	2,299	2,230	2,520	3,049	6,200
Logic	3,135	3,385	3,250	3,800	4,600	9,800
Linear	$ 3,847	$ 4,198	$ 4,055	$ 4,623	$ 5,548	$ 9,000
Total Discrete	$ 3,019	$ 3,234	$ 3,066	$ 3,403	$ 3,914	$ 5,300
Total Optoelectronic	$ 1,136	$ 1,252	$ 1,235	$ 1,407	$ 1,646	$ 2,700

Source: Dataquest
June 1988

Semiconductor Consumption

Table 3d

Japanese Semiconductor Market
(Compound Annual Growth Rate Based on U.S. Dollars)

	CAGR (77-82)	CAGR (82-87)	CAGR (87-92)	CAGR (92-97)	CAGR (77-87)	CAGR (87-97)
Total Semiconductor	18.8%	28.5%	12.1%	12.3%	23.6%	12.2%
Total IC	27.0%	31.0%	12.5%	13.5%	29.0%	13.0%
Bipolar Digital	21.3%	24.5%	11.9%	10.4%	22.9%	11.2%
Memory	N/A	16.0%	(1.5%)	(10.1%)	N/A	(5.9%)
Logic	N/A	26.1%	13.4%	11.4%	N/A	12.4%
MOS Digital	32.1%	38.0%	13.0%	15.5%	35.0%	14.3%
Memory	N/A	34.0%	11.7%	14.7%	N/A	13.2%
Micro	N/A	31.2%	12.0%	15.3%	N/A	13.6%
Logic	N/A	51.8%	15.0%	16.3%	N/A	15.7%
Linear	24.9%	23.9%	11.7%	10.2%	24.4%	10.9%
Total Discrete	4.1%	20.1%	7.3%	6.3%	11.8%	8.1%
Total Optoelectronic	30.8%	28.5%	12.3%	10.4%	29.6%	11.6%

Source: Dataquest
June 1988

Semiconductor Consumption

Table 4a

Japanese Semiconductor Market
(Billions of Yen)

	1976	1977	1978	1979	1980	1981
Total Semiconductor	¥483	¥463	¥514	¥607	¥768	¥949
Total IC	¥233	¥232	¥294	¥381	¥500	¥617
Bipolar Digital	¥ 52	¥ 51	¥ 54	¥ 67	¥ 78	¥ 97
Memory				11	13	17
Logic				55	65	80
MOS Digital	¥ 91	¥ 84	¥123	¥167	¥225	¥259
Memory				56	96	109
Micro				47	61	89
Logic				64	68	62
Linear	¥ 91	¥ 97	¥116	¥147	¥196	¥261
Total Discrete	¥237	¥213	¥199	¥195	¥224	¥273
Total Optoelectronic	¥ 13	¥ 18	¥ 22	¥ 31	¥ 44	¥ 59

Source: Dataquest
June 1988

Semiconductor Consumption

Table 4b

Japanese Semiconductor Market
(Billions of Yen)

	1982	1983	1984	1985	1986	1987
Total Semiconductor	¥1,012	¥1,344	¥2,080	¥1,939	¥1,979	¥2,064
Total IC	¥ 708	¥ 979	¥1,545	¥1,424	¥1,483	¥1,585
Bipolar Digital	¥ 124	¥ 166	¥ 226	¥ 196	¥ 222	¥ 215
Memory	22	26	39	32	28	26
Logic	102	140	188	164	193	188
MOS Digital	¥ 313	¥ 458	¥ 858	¥ 769	¥ 801	¥ 911
Memory	132	210	374	282	293	333
Micro	111	140	232	210	229	249
Logic	70	108	252	277	279	329
Linear	¥ 271	¥ 356	¥ 460	¥ 459	¥ 460	¥ 459
Total Discrete	¥ 241	¥ 286	¥ 416	¥ 386	¥ 361	¥ 349
Total Optoelectronic	¥ 64	¥ 79	¥ 119	¥ 129	¥ 135	¥ 129

Source: Dataquest
June 1988

Table 4c

Japanese Semiconductor Market
(Billions of Yen)

	1988	1989	1990	1991	1992	1997
Total Semiconductor	¥2,368	¥2,580	¥2,442	¥2,739	¥3,303	¥5,889
Total IC	¥1,828	¥1,997	¥1,883	¥2,114	¥2,580	¥4,849
Bipolar Digital	¥ 249	¥ 267	¥ 255	¥ 290	¥ 341	¥ 559
Memory	28	29	28	26	22	13
Logic	222	238	228	264	319	546
MOS Digital	¥1,078	¥1,184	¥1,101	¥1,223	¥1,518	¥3,120
Memory	396	445	389	401	524	1,040
Micro	275	299	290	328	396	806
Logic	408	440	423	494	598	1,274
Linear	¥ 500	¥ 546	¥ 527	¥ 601	¥ 721	¥1,170
Total Discrete	¥ 392	¥ 420	¥ 399	¥ 442	¥ 509	¥ 689
Total Optoelectronic	¥ 148	¥ 163	¥ 161	¥ 183	¥ 214	¥ 351

Source: Dataquest
June 1988

Semiconductor Consumption

Table 4d

Japanese Semiconductor Market
(Compound Annual Growth Rate Based on Yen)

	CAGR (77-82)	CAGR (82-87)	CAGR (87-92)	CAGR (92-97)	CAGR (77-87)	CAGR (87-97)
Total Semiconductor	16.9%	15.3%	9.9%	12.3%	16.1%	11.1%
Total IC	25.0%	17.5%	10.2%	13.5%	21.2%	11.8%
Bipolar Digital	19.3%	11.7%	9.7%	10.4%	15.4%	10.0%
Memory	N/A	4.1%	(3.5%)	(10.1%)	N/A	(6.8%)
Logic	N/A	13.1%	11.1%	11.4%	N/A	11.2%
MOS Digital	30.0%	23.8%	10.7%	15.5%	26.8%	13.1%
Memory	N/A	20.2%	9.5%	14.7%	N/A	12.1%
Micro	N/A	17.7%	9.7%	15.3%	N/A	12.4%
Logic	N/A	36.2%	12.7%	16.3%	N/A	14.5%
Linear	22.9%	11.1%	9.5%	10.2%	16.8%	9.8%
Total Discrete	2.5%	7.7%	7.3%	6.3%	5.1%	7.0%
Total Optoelectronic	28.7%	15.2%	12.3%	10.4%	21.8%	10.5%

Source: Dataquest
June 1988

Semiconductor Consumption

Table 5a

Western European Semiconductor Market
(Millions of Dollars)

	1976	1977	1978	1979	1980	1981
Total Semiconductor	$1,594	$1,886	$2,339	$3,018	$3,686	$3,041
Total IC	$ 676	$ 904	$1,238	$1,747	$2,333	$1,892
Bipolar Digital	$ 186	$ 228	$ 291	$ 390	$ 510	$ 454
Memory				85	116	103
Logic				305	394	351
MOS Digital	$ 226	$ 352	$ 535	$ 781	$1,139	$ 882
Memory				367	543	426
Micro				125	189	149
Logic				289	407	307
Linear	$ 264	$ 324	$ 412	$ 576	$ 684	$ 556
Total Discrete	$ 851	$ 914	$1,004	$1,138	$1,192	$ 995
Total Optoelectronic	$ 67	$ 68	$ 97	$ 133	$ 161	$ 154

Source: Dataquest
June 1988

Semiconductor Consumption

Table 5b

Western European Semiconductor Market
(Millions of Dollars)

	1982	1983	1984	1985	1986	1987
Total Semiconductor	$3,167	$3,370	$4,907	$4,839	$5,485	$6,355
Total IC	$1,988	$2,323	$3,752	$3,634	$4,041	$4,693
Bipolar Digital	$ 434	$ 483	$ 741	$ 719	$ 735	$ 725
Memory	100	107	144	150	125	85
Logic	334	376	597	569	610	640
MOS Digital	$ 948	$1,227	$2,146	$1,952	$2,280	$2,753
Memory	469	581	990	749	822	838
Micro	168	239	476	489	578	794
Logic	311	407	680	714	880	1,121
Linear	$ 606	$ 613	$ 865	$ 963	$1,026	$1,215
Total Discrete	$1,011	$ 866	$ 955	$ 981	$1,153	$1,384
Total Optoelectronic	$ 168	$ 181	$ 200	$ 224	$ 291	$ 278

Source: Dataquest
June 1988

Semiconductor Consumption

Table 5c

Western European Semiconductor Market
(Millions of Dollars)

	1988	1989	1990	1991	1992	1997
Total Semiconductor	$7,642	$8,130	$8,325	$9,180	$10,398	$16,150
Total IC	$5,789	$6,192	$6,248	$6,982	$ 8,027	$13,250
Bipolar Digital	$ 832	$ 864	$ 865	$ 897	$ 944	$ 1,150
Memory	91	93	91	86	84	50
Logic	741	771	774	811	860	1,100
MOS Digital	$3,575	$3,910	$4,013	$4,608	$ 5,464	$10,000
Memory	1,133	1,278	1,257	1,442	1,745	3,200
Micro	1,015	1,105	1,124	1,265	1,447	2,400
Logic	1,427	1,527	1,632	1,901	2,272	4,400
Linear	$1,382	$1,418	$1,370	$1,477	$ 1,619	$ 2,100
Total Discrete	$1,531	$1,599	$1,715	$1,811	$ 1,940	$ 2,300
Total Optoelectronic	$ 322	$ 339	$ 362	$ 387	$ 431	$ 600

Source: Dataquest
June 1988

Semiconductor Consumption

Table 5d

Western European Semiconductor Market
(Compound Annual Growth Rates)

	CAGR (77-82)	CAGR (82-87)	CAGR (87-92)	CAGR (92-97)	CAGR (77-87)	CAGR (87-97)
Total Semiconductor	10.9%	14.9%	10.3%	9.2%	12.9%	9.8%
Total IC	17.1%	18.7%	11.3%	10.5%	17.9%	10.9%
Bipolar Digital	13.7%	10.8%	5.4%	4.0%	12.3%	4.7%
Memory	N/A	(3.2%)	(0.2%)	(9.9%)	N/A	(5.2%)
Logic	N/A	13.9%	6.1%	5.0%	N/A	5.6%
MOS Digital	21.9%	23.8%	14.7%	12.8%	22.8%	13.8%
Memory	N/A	12.3%	15.8%	12.9%	N/A	14.3%
Micro	N/A	36.4%	12.8%	10.6%	N/A	11.7%
Logic	N/A	29.2%	15.2%	14.1%	N/A	14.7%
Linear	13.3%	14.9%	5.9%	5.3%	14.1%	5.6%
Total Discrete	2.0%	6.5%	4.0%	3.5%	4.2%	5.2%
Total Optoelectronic	19.8%	10.6%	6.7%	6.8%	15.1%	8.0%

Source: Dataquest
June 1988

Semiconductor Consumption

Table 6a

Rest of World Semiconductor Market
(Millions of Dollars)

	1976	1977	1978	1979	1980	1981
Total Semiconductor	$333	$483	$660	$790	$996	$963
Total IC	$134	$184	$258	$364	$450	$494
Bipolar Digital	$ 35	$ 39	$ 45	$ 79	$108	$106
Memory				2	3	3
Logic				77	105	103
MOS Digital	$ 67	$ 88	$110	$100	$143	$171
Memory				25	34	51
Micro				17	27	43
Logic				58	82	77
Linear	$ 32	$ 57	$103	$185	$199	$217
Total Discrete	$171	$257	$346	$334	$436	$375
Total Optoelectronic	$ 28	$ 42	$ 56	$ 92	$110	$ 94

Source: Dataquest
June 1988

Semiconductor Consumption

Table 6b

Rest of World Semiconductor Market
(Millions of Dollars)

	1982	1983	1984	1985	1986	1987
Total Semiconductor	$1,042	$1,443	$2,216	$1,949	$2,365	$3,945
Total IC	$ 585	$ 909	$1,328	$1,179	$1,726	$2,978
Bipolar Digital	$ 113	$ 162	$ 257	$ 203	$ 256	$ 384
Memory	4	14	26	15	12	18
Logic	109	148	231	188	244	366
MOS Digital	$ 248	$ 450	$ 700	$ 616	$ 887	$1,580
Memory	106	194	234	134	244	523
Micro	63	112	145	117	244	476
Logic	79	144	321	365	399	581
Linear	$ 224	$ 297	$ 371	$ 360	$ 583	$1,014
Total Discrete	$ 365	$ 429	$ 773	$ 679	$ 553	$ 862
Total Optoelectronic	$ 92	$ 105	$ 115	$ 91	$ 86	$ 105

Source: Dataquest
June 1988

Semiconductor Consumption

Table 6c

Rest of World Semiconductor Market
(Millions of Dollars)

	1988	1989	1990	1991	1992	1997
Total Semiconductor	$5,469	$6,643	$7,097	$8,908	$11,376	$22,310
Total IC	$4,273	$5,356	$5,758	$7,355	$ 9,570	$19,560
Bipolar Digital	$ 511	$ 606	$ 658	$ 837	$ 1,084	$ 1,560
Memory	18	19	18	17	15	10
Logic	493	587	640	820	1,069	1,550
MOS Digital	$2,326	$3,020	$3,145	$4,023	$ 5,245	$11,000
Memory	863	1,163	1,222	1,510	1,900	4,000
Micro	676	839	874	1,067	1,328	2,600
Logic	787	1,018	1,049	1,446	2,017	4,400
Linear	$1,436	$1,730	$1,955	$2,495	$ 3,241	$ 7,000
Total Discrete	$1,062	$1,153	$1,190	$1,372	$ 1,583	$ 2,400
Total Optoelectronic	$ 134	$ 134	$ 149	$ 181	$ 223	$ 350

Source: Dataquest
June 1988

Semiconductor Consumption

Table 6d

Rest of World Semiconductor Market
(Compound Annual Growth Rates)

	CAGR (77-82)	CAGR (82-87)	CAGR (87-92)	CAGR (92-97)	CAGR (77-87)	CAGR (87-97)
Total Semiconductor	16.6%	30.5%	23.6%	14.4%	23.4%	18.9%
Total IC	26.0%	38.5%	26.3%	15.4%	32.1%	20.7%
Bipolar Digital	23.7%	27.7%	23.1%	7.6%	25.7%	15.0%
Memory	N/A	35.1%	(3.6%)	(7.8%)	N/A	(5.7%)
Logic	N/A	27.4%	23.9%	7.7%	N/A	15.5%
MOS Digital	23.0%	44.8%	27.1%	16.0%	33.5%	21.4%
Memory	N/A	37.6%	29.4%	16.1%	N/A	22.6%
Micro	N/A	49.8%	22.8%	14.4%	N/A	18.5%
Logic	N/A	49.0%	28.3%	16.9%	N/A	22.4%
Linear	31.5%	35.3%	26.2%	16.6%	33.4%	21.3%
Total Discrete	7.3%	18.8%	9.7%	8.7%	12.9%	10.8%
Total Optoelectronic	17.0%	2.7%	11.4%	9.4%	9.6%	12.8%

Source: Dataquest
June 1988

Semiconductor Consumption

Table 7a

Worldwide Average Selling Prices (Dollars)

	1976	1977	1978	1979	1980	1981
Total Semiconductor	$0.29	$0.28	$0.28	$0.29	$0.33	$0.31
Total IC	$1.00	$1.02	$1.01	$0.97	$1.07	$1.02
Bipolar Digital	$0.61	$0.66	$0.63	$0.57	$0.70	$0.70
Memory						
Logic						
MOS Digital	$2.39	$2.06	$1.91	$1.93	$1.81	$1.66
Memory				5.15	4.90	3.17
Micro				3.96	3.61	3.40
Logic				0.89	0.85	0.86
Linear	$0.85	$0.83	$0.84	$0.78	$0.83	$0.81
Total Discrete	$0.15	$0.14	$0.13	$0.12	$0.12	$0.11
Total Optoelectronic	$0.67	$0.45	$0.47	$0.51	$0.44	$0.39

Source: Dataquest
June 1988

Semiconductor Consumption

Table 7b

Worldwide Average Selling Prices
(Dollars)

	1982	1983	1984	1985	1986	1987
Total Semiconductor	$0.34	$0.33	$0.37	$0.34	$0.36	$0.38
Total IC	$1.01	$1.04	$1.11	$1.06	$1.12	$1.19
Bipolar Digital	$0.62	$0.65	$0.65	$0.71	$0.71	$0.69
Memory						
Logic						
MOS Digital	$1.71	$1.73	$2.01	$1.69	$1.73	$1.97
Memory	3.06	3.21	3.90	2.59	2.45	2.91
Micro	3.34	3.40	4.41	3.91	3.90	4.30
Logic	0.80	0.79	0.85	0.93	0.99	1.12
Linear	$0.79	$0.76	$0.75	$0.76	$0.84	$0.82
Total Discrete	$0.11	$0.09	$0.09	$0.09	$0.09	$0.09
Total Optoelectronic	$0.38	$0.37	$0.36	$0.33	$0.36	$0.34

Source: Dataquest
June 1988

Semiconductor Consumption

Table 7c

Worldwide Average Selling Prices (Dollars)

	1988	1989	1990	1991	1992	1997
Total Semiconductor	$0.43	$0.42	$0.43	$0.46	$0.49	$0.60
Total IC	$1.26	$1.25	$1.28	$1.34	$1.33	$1.63
Bipolar Digital	$0.70	$0.70	$0.73	$0.76	$0.78	$0.85
Memory						
Logic						
MOS Digital	$2.11	$2.05	$2.08	$2.22	$2.05	$2.74
Memory	3.15	2.90	3.05	3.10	3.30	3.80
Micro	4.46	4.15	4.15	4.35	4.85	4.50
Logic	1.20	1.20	1.22	1.36	1.43	1.80
Linear	$0.82	$0.81	$0.83	$0.85	$0.86	$0.90
Total Discrete	$0.10	$0.10	$0.10	$0.10	$0.10	$0.10
Total Optoelectronic	$0.33	$0.31	$0.32	$0.34	$0.35	$0.37

Source: Dataquest
June 1988

Semiconductor Consumption

Table 7d

Worldwide Average Selling Prices
(Compound Annual Growth Rates Based on U.S. Dollars)

	CAGR (77-82)	CAGR (82-87)	CAGR (87-92)	CAGR (92-97)	CAGR (77-87)	CAGR (87-97)
Total Semiconductor	4.0%	2.5%	5.2%	4.2%	3.2%	4.7%
Total IC	(0.1%)	3.4%	2.2%	4.1%	1.6%	3.2%
Bipolar Digital	(1.2%)	2.2%	2.5%	1.7%	0.4%	2.1%
Memory	N/A	N/A	N/A	N/A	N/A	N/A
Logic	N/A	N/A	N/A	N/A	N/A	N/A
MOS Digital	(3.7%)	3.0%	0.7%	6.0%	(0.4%)	3.3%
Memory	N/A	(1.0%)	2.5%	2.9%	N/A	2.7%
Micro	N/A	5.2%	2.4%	(1.5%)	N/A	0.5%
Logic	N/A	7.0%	5.0%	4.7%	N/A	4.9%
Linear	(1.0%)	0.7%	1.0%	0.9%	(0.1%)	0.9%
Total Discrete	(4.7%)	(3.5%)	2.5%	(0.8%)	(4.1%)	0.8%
Total Optoelectronic	(3.3%)	(2.2%)	0.6%	1.1%	(2.8%)	0.8%

Source: Dataquest
June 1988

Semiconductor Consumption

Table 8a

Worldwide Semiconductor Market
(Millions of Units)

	1976	1977	1978	1979	1980	1981
Total Semiconductor	$20,929	$25,110	$31,461	$37,703	$42,870	$48,081
Total IC	$ 3,093	$ 3,703	$ 5,171	$ 7,242	$ 8,955	$ 9,809
Bipolar Digital	$ 1,418	$ 1,506	$ 2,002	$ 2,937	$ 3,391	$ 3,339
Memory						
Logic						
MOS Digital	$ 518	$ 769	$ 1,221	$ 1,731	$ 2,603	$ 2,906
Memory				325	455	655
Micro				137	239	319
Logic				1,269	1,909	1,933
Linear	$ 1,156	$ 1,428	$ 1,949	$ 2,574	$ 2,960	$ 3,564
Total Discrete	$17,413	$20,736	$25,392	$29,350	$32,358	$36,227
Total Optoelectronic	$ 422	$ 671	$ 898	$ 1,111	$ 1,557	$ 2,045

Source: Dataquest
June 1988

Semiconductor Consumption

Table 8b

Worldwide Semiconductor Market
(Millions of Units)

	1982	1983	1984	1985	1986	1987
Total Semiconductor	$45,195	$59,717	$79,180	$71,961	$81,667	$95,551
Total IC	$10,791	$14,144	$20,390	$17,435	$20,462	$24,063
Bipolar Digital	$ 3,890	$ 4,638	$ 7,340	$ 5,172	$ 6,069	$ 6,771
Memory						
Logic						
MOS Digital	$ 3,306	$ 4,593	$ 6,456	$ 5,999	$ 7,208	$ 8,502
Memory	883	1,159	1,597	1,475	1,899	2,068
Micro	395	582	733	703	892	1,121
Logic	2,029	2,852	4,126	3,820	4,417	5,313
Linear	$ 3,595	$ 4,913	$ 6,593	$ 6,264	$ 7,186	$ 8,790
Total Discrete	$32,245	$42,944	$55,411	$50,844	$56,761	$66,435
Total Optoelectronic	$ 2,159	$ 2,629	$ 3,379	$ 3,682	$ 4,444	$ 5,053

Source: Dataquest
June 1988

Semiconductor Consumption

Table 8c

Worldwide Semiconductor Market
(Millions of Units)

	1988	1989	1990	1991	1992	1997
Total Semiconductor	$107,337	$118,334	$115,785	$123,802	$141,395	$200,252
Total IC	$ 29,158	$ 32,287	$ 31,036	$ 34,518	$ 43,038	$ 63,793
Bipolar Digital	$ 7,901	$ 8,430	$ 7,851	$ 8,542	$ 9,708	$ 12,659
Memory						
Logic						
MOS Digital	$ 10,703	$ 12,218	$ 11,679	$ 12,870	$ 17,688	$ 25,579
Memory	2,707	3,304	2,940	3,331	3,823	6,579
Micro	1,380	1,625	1,591	1,780	2,480	4,000
Logic	6,616	7,289	7,148	7,759	11,385	$ 15,000
Linear	$ 10,554	$ 11,638	$ 11,506	$ 13,106	$ 15,642	$ 25,556
Total Discrete	$ 71,850	$ 78,885	$ 77,684	$ 81,755	$ 89,817	$124,000
Total Optoelectronic	$ 6,329	$ 7,161	$ 7,066	$ 7,529	$ 8,540	$ 12,459

Source: Dataquest
June 1988

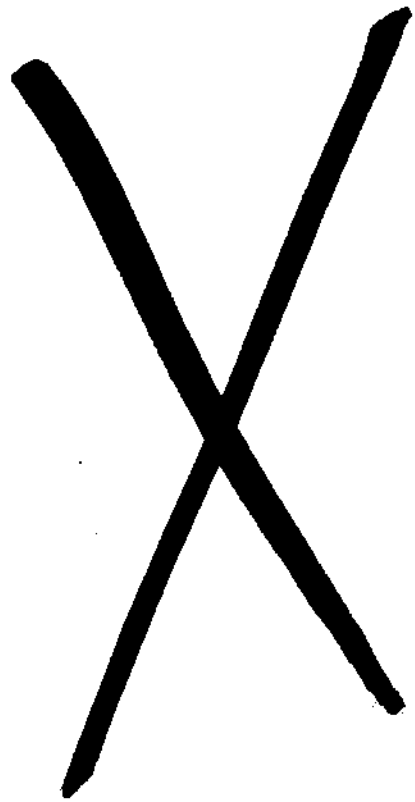
Semiconductor Consumption

Table 8d

Worldwide Semiconductor Market
(Compound Annual Growth Rates Based on Millions of Units)

	CAGR (77-82)	CAGR (82-87)	CAGR (87-92)	CAGR (92-97)	CAGR (77-87)	CAGR (87-97)
Total Semiconductor	12.5%	16.2%	8.2%	7.2%	14.3%	7.7%
Total IC	23.9%	17.4%	12.3%	8.2%	20.6%	10.2%
Bipolar Digital	20.9%	11.7%	7.5%	5.5%	16.2%	6.5%
Memory	N/A	N/A	N/A	N/A	N/A	N/A
Logic	N/A	N/A	N/A	N/A	N/A	N/A
MOS Digital	33.9%	20.8%	15.8%	7.7%	27.2%	11.6%
Memory	N/A	18.6%	13.1%	11.5%	N/A	12.3%
Micro	N/A	23.2%	17.2%	10.0%	N/A	13.6%
Logic	N/A	21.2%	16.5%	5.7%	N/A	10.9%
Linear	20.3%	19.6%	12.2%	10.3%	19.9%	11.3%
Total Discrete	9.2%	15.6%	6.2%	6.7%	12.3%	6.4%
Total Optoelectronic	26.3%	18.5%	11.1%	7.8%	22.4%	9.4%

Source: Dataquest
June 1988



Semiconductor Consumption

INTRODUCTION

Semiconductor consumption data comprise a set of detailed tables that estimate the size of the semiconductor total available market (TAM) worldwide and for four major geographical regions for the years 1978 through 1993 and 1998. Semiconductor consumption tables contain both historical data and forecasts. Historical data begin with 1978 and end with 1987, while forecast data provide annual market size estimates for 1988 through 1993, with additional estimates for 1998. Below is a list of tables detailing the type of data, region, time period, and units of measure.

LIST OF TABLES

(Continued)

LIST OF TABLES (Continued)

Each table gives estimates of semiconductor consumption listed by the major semiconductor device product categories. In these tables, semiconductor components are divided into three major product groups: integrated circuits, discrete devices, and optoelectronic devices. These groups are divided into a number of subgroups, some of which are segmented further.

Semiconductor Consumption

DEFINITIONS AND CONVENTIONS

Dataquest uses a common manufacturer base for all data tables. This base includes all suppliers to the merchant semiconductor market. It excludes captive suppliers that manufacture devices solely for the benefit of the parent company, such as AT&T, Burroughs, Delco, and IBM. Included, however, are companies that actively market semiconductor devices to the merchant market as well as to other divisions of their own companies. For such companies, both external shipments and internal consumption are included. Devices that are used internally are valued at current market prices.

Consumption—Dataquest defines consumption as the purchase of a semiconductor device or devices. This definition must be differentiated from actual use of the device in a final product. Devices that are inventoried at the user level are considered consumption according to our definition. The terms consumption and market size are used interchangeably. Thus, a regional market includes all devices sold to or shipped to that region, i.e. the total available market (TAM) in that region.

Hybrids—In earlier consumption data, hybrid devices were included as a separate segment of integrated circuits. However, since hybrid devices are primarily a special packaging arrangement, this segment has been omitted. Hybrid devices manufactured by semiconductor companies are now included in the most appropriate product segment, usually the analog segment.

The manufacturer base, product group definitions, and guidelines for including value of output that we have used in our tables may differ from those used in other studies of this type. Our base is nearly the same as that used by the World Semiconductor Trade Statistics program (WSTS), with the following exceptions:

- Dataquest includes all of AT&T's semiconductor revenue, both merchant and captive.
- Dataquest includes—and has included all along—nonrecurring engineering (NRE) charges associated with application-specific integrated circuit (ASIC) revenue. (This applies to both the bipolar digital and MOS digital logic categories.)
- Dataquest includes the revenue generated by sales of standalone circuit design software, sold by certain U.S. manufacturers of ASIC logic devices.
- Dataquest includes Signetics revenue with that of its parent company, Netherlands-based N.V. Philips.
- Dataquest includes revenue for Taiwanese semiconductor manufacturers.

- Dataquest includes revenue for three Japanese companies not estimated by WSTS: NBM Semiconductor, Seiko Epson, and Yamaha.
- As noted herein, Dataquest includes hybrid revenue in the analog category.

Further information on the above points is available through Dataquest's Client Inquiry Center, at (408) 437-8099.

Regions—North America is defined as including both the United States and Canada. Latin America, including Mexico, is considered part of the Rest of World (ROW) category. The ROW region also includes Asia-Pacific (Korea, Taiwan, Hong Kong, Singapore, and China). Western Europe includes Austria, Belgium, the Federal Republic of Germany, France, Italy, Luxembourg, the Scandinavian countries (Denmark, Finland, Norway, Sweden), Spain, and the United Kingdom. Japan, the fourth region, is the only single-country region.

DATA SOURCES

The information presented in the consumption data has been consolidated from a variety of sources, each of which focuses on a specific part of the market. These sources include the following:

- World Semiconductor Trade Statistics (WSTS) data, and Dataquest's estimates of regional company sales are used to determine North American consumption.
- Japanese trade statistics compiled and published by the Ministry of Finance (MOF) and the Ministry of International Trade and Industry (MITI), WSTS data, and Dataquest's estimates of regional company sales are used to determine Japanese consumption.
- For Western European markets, marketing statistics from WSTS data and Dataquest's estimates of regional company sales are used to determine consumption.
- In ROW, the major published sources used to estimate consumption are WSTS data and Dataquest's estimates of company shipments into the region.

Dataquest believes that the estimates presented here are the most accurate and meaningful generally available today. The sources of the data and the guidelines for the forecasts presented in the tables are:

- Unit sales or revenue (or both) published by major industry participants, both in the United States and abroad
- Estimates presented by knowledgeable and reliable industry spokesmen

- Government data or trade association data such as those from the Electronics Industry Association (EIA), MITI, WSTS, and the U.S. Department of Commerce
- Published product literature and price lists
- Interviews with knowledgeable manufacturers, distributors, and users
- Relevant projected world economic data

ACCURACY

The tables presented here represent Dataquest estimates that we believe are reasonably accurate. Where we have no reasonable estimate, none is given. A blank space in a table indicates that a reasonably accurate estimate is unavailable, and a zero in a table represents an estimate.

VALUATION OF CONSUMPTION

Regional consumption is expressed in U.S. dollars (with Japanese consumption and shipments also expressed in yen). To make the tables in this study useful in comparing different regions, it is necessary to express all values in a common currency, and we chose the U.S. dollar for convenience.

However, the choice of the U.S. dollar (or any single currency, for that matter) as the currency basis for the tables brings with it some problems that require the readers' careful consideration in interpreting the data.

Inflation

All countries that participate significantly in international semiconductor markets suffered from an overall price inflation in the 1970s, continuing into the 1980s.

As a consequence, the dollar in a given year is not truly comparable with the dollar in any preceding year. Consumer and wholesale price indices and GNP deflators all measure price changes in various composite "market baskets" of goods. However, there is no price index that measures price changes of material, equipment, and labor inputs to the semiconductor industry. Indeed, the "mix" is changing so rapidly that what is used this year was sometimes unavailable last year, at any price. Nor is there a composite price index that measures price changes in aggregate semiconductor product. In an industry noted for its deflationary trends, this latter effect would tend to make the component purchaser's dollar worth more as time passed, in terms of purchasing ability.

We have made no adjustments in the historical data to account for these inflationary and deflationary effects. The data are expressed in current dollars (dollars that include the inflation rate and exchange rates of the given year) for all historical data; comparisons between different years must be interpreted accordingly.

Average Selling Prices

When considering the worldwide average selling prices (ASPs) for semiconductor components, one must look at the price per function of a circuit, the complexity of the circuit, and the product mix according to this increasing complexity. It is true that one characteristic of the semiconductor industry is that the price per function for integrated circuits has been dropping an average of 30 percent per year for the last 15 years. At the same time, circuits have become denser, resulting in an overall increase in the price of a device with a decreasing cost per function. Thus, Tables 7a through 7g show the worldwide ASPs increasing after many years of decreasing, due to the move toward higher-complexity devices. There are also regional differences in ASPs due to regional competition differences and the varying regional product consumption mix. The worldwide ASP is truly an aggregate measure and may differ significantly from ASPs in any specific market at any point in time.

Exchange Rates

Construction of the West European tables involves combining data from many countries, each of which has different and changing exchange rates. Dataquest uses Annual Foreign Exchange Rates for each year as published by The International Monetary Fund. As far as possible, we prepare our estimates in terms of local currencies before conversion to U.S. dollars. The exchange rates for major currencies can be found in Table 0 at the end of this introduction.

Japanese consumption is based on MITI data, originally expressed in yen. The Japanese data published in this study are expressed in both dollars (Tables 3a, 3b, and 3c) and in yen (Tables 4a, 4b, and 4c). The yen/dollar exchange rate used for each year can be found in Table 0. Because of the fluctuations in the exchange rate for the yen, the dollar values given tend to distort the growth rate of the Japanese market, but they do provide a useful basis for regional market size comparisons. However, the data in yen give a better picture of the real growth in the Japanese market.

FORECAST

As mentioned previously, historical data are expressed in current dollars or dollars that include the given year's inflation rate and exchange rates. However, the consumption forecasts use constant dollars and exchange rates, with no allowance for inflation or variations in the rates of exchange between countries. All estimates for 1988 and beyond are made as if 1988 monetary conditions will continue through 1998 and, therefore, show the absolute year-to-year growth during this period.

Table 0

Foreign Exchange Rates
(In U.S. Dollars)

Year	Yrly/ Qtrly	Japan (Yen per US$)	France (US$ per Franc)	West Germany (US$ per Deutsche Mark)	United Kingdom (US$ per Pound Sterling)	European Basket ECU (1980 = 100)
1970	YR	358	$0.18	$0.27	$2.38	
1971	YR	343	$0.18	$0.29	$2.44	
1972	YR	302	$0.20	$0.31	$2.50	
1973	YR	269	$0.22	$0.37	$2.44	
1974	YR	292	$0.21	$0.39	$2.33	
1975	YR	297	$0.23	$0.41	$2.22	
1976	YR	296	$0.21	$0.40	$1.82	
1977	YR	269	$0.20	$0.43	$1.75	
1978	YR	210	$0.22	$0.50	$1.92	
1979	YR	219	$0.24	$0.55	$2.13	
1980	YR	227	$0.24	$0.55	$2.33	100
1981	YR	221	$0.18	$0.44	$2.04	124
1982	YR	248	$0.15	$0.41	$1.75	141
1983	YR	235	$0.13	$0.39	$1.52	158
1984	YR	237	$0.11	$0.35	$1.33	178
1985	YR	238	$0.11	$0.34	$1.30	185
1986	YR	167	$0.14	$0.46	$1.47	146
1987	YR	144	$0.17	$0.56	$1.64	126
1988	YR	130	$0.17	$0.57	$1.79	121

Source: The International Monetary Fund
Financial Times
Dataquest
May 1989

Semiconductor Consumption

Table 1a

Worldwide Semiconductor Market
(Millions of Dollars)

	1978	1979	1980	1981	1982
Total Semiconductor	8,953	11,114	14,118	14,828	15,261
Total IC	5,230	7,028	9,546	10,046	10,894
Bipolar Digital	1,261	1,674	2,374	2,337	2,412
Memory		324	572	558	511
Logic		1,350	1,802	1,779	1,901
MOS Digital	2,332	3,346	4,715	4,822	5,642
Memory		1,676	2,230	2,075	2,701
Micro		541	862	1,085	1,318
Logic		1,129	1,623	1,662	1,623
Analog	1,637	2,008	2,457	2,887	2,840
Total Discrete	3,301	3,522	3,883	3,985	3,547
Total Optoelectronic	422	564	689	797	820

Source: Dataquest
May 1989

Semiconductor Consumption

Table 1b

Worldwide Semiconductor Market
(Millions of Dollars)

	1983	1984	1985	1986	1987	1988
Total Semiconductor	19,537	28,903	24,357	30,834	38,278	50,486
Total IC	14,700	22,686	18,555	23,618	29,904	40,800
Bipolar Digital	3,015	4,771	3,672	4,325	4,762	5,197
Memory	603	774	589	606	621	670
Logic	2,412	3,997	3,083	3,719	4,141	4,527
MOS Digital	7,951	12,970	10,122	12,815	17,488	26,780
Memory	3,719	6,229	3,821	4,511	6,081	11,571
Micro	1,979	3,234	2,748	3,489	5,099	7,127
Logic	2,253	3,507	3,553	4,815	6,308	8,082
Analog	3,734	4,945	4,761	6,478	7,654	8,823
Total Discrete	3,865	4,987	4,576	5,730	6,665	7,543
Total Optoelectronic	972	1,230	1,226	1,486	1,709	2,143

Source: Dataquest
May 1989

Semiconductor Consumption

Table 1c

Worldwide Semiconductor Market
(Millions of Dollars)

	1989	1990	1991	1992	1993	1998
Total Semiconductor	58,204	57,890	67,460	83,034	109,360	238,431
Total IC	47,679	47,152	55,515	69,427	93,767	215,083
Bipolar Digital	4,582	4,394	4,654	5,085	5,623	6,535
Memory	601	565	553	512	494	400
Logic	3,981	3,829	4,101	4,573	5,129	6,135
MOS Digital	33,486	32,761	39,226	50,303	71,093	179,730
Memory	16,962	15,582	18,383	23,550	36,561	105,074
Micro	7,526	8,115	9,870	12,835	16,801	38,002
Logic	8,998	9,064	10,973	13,918	17,731	36,654
Analog	9,611	9,997	11,635	14,039	17,051	28,818
Total Discrete	8,064	8,180	9,060	10,266	11,677	16,635
Total Optoelectronic	2,461	2,558	2,885	3,341	3,916	6,713

Source: Dataquest
May 1989

Semiconductor Consumption

Table 1d

Worldwide Semiconductor Market
(Percent Change)

	1978	1979	1980	1981	1982
Total Semiconductor	28.5%	24.1%	27.0%	5.0%	2.9%
Total IC	39.0%	34.4%	35.8%	5.2%	8.4%
Bipolar Digital	26.9%	32.8%	41.8%	(1.6%)	3.2%
Memory	N/A	N/A	76.5%	(2.4%)	(8.4%)
Logic	N/A	N/A	33.5%	(1.3%)	6.9%
MOS Digital	47.2%	43.5%	40.9%	2.3%	17.0%
Memory	N/A	N/A	33.1%	(7.0%)	30.2%
Micro	N/A	N/A	59.3%	25.9%	21.5%
Logic	N/A	N/A	43.8%	2.4%	(2.3%)
Analog	38.1%	22.7%	22.4%	17.5%	(1.6%)
Total Discrete	13.7%	6.7%	10.2%	2.6%	(11.0%)
Total Optoelectronic	39.7%	33.6%	22.2%	15.7%	2.9%

N/A = Not Available

Source: Dataquest
May 1989

Semiconductor Consumption

Table 1e

Worldwide Semiconductor Market
(Percent Change)

	1983	1984	1985	1986	1987	1988
Total Semiconductor	28.0%	47.9%	(15.7%)	26.6%	24.1%	31.9%
Total IC	34.9%	54.3%	(18.2%)	27.3%	26.6%	36.4%
Bipolar Digital	25.0%	58.2%	(23.0%)	17.8%	10.1%	9.1%
Memory	18.0%	28.4%	(23.9%)	2.9%	2.5%	7.9%
Logic	26.9%	65.7%	(22.9%)	20.6%	11.3%	9.3%
MOS Digital	40.9%	63.1%	(22.0%)	26.6%	36.5%	53.1%
Memory	37.7%	67.5%	(38.7%)	18.1%	34.8%	90.3%
Micro	50.2%	63.4%	(15.0%)	27.0%	46.1%	39.8%
Logic	38.8%	55.7%	1.3%	35.5%	31.0%	28.1%
Analog	31.5%	32.4%	(3.7%)	36.1%	18.2%	15.3%
Total Discrete	9.0%	29.0%	(8.2%)	25.2%	16.3%	13.2%
Total Optoelectronic	18.5%	26.5%	(0.3%)	21.2%	15.0%	25.4%

Source: Dataquest
May 1989

Semiconductor Consumption

Table 1f

Worldwide Semiconductor Market
(Percent Change)

	1989	1990	1991	1992	1993
Total Semiconductor	15.3%	(0.5%)	16.5%	23.1%	31.7%
Total IC	16.9%	(1.1%)	17.7%	25.1%	35.1%
Bipolar Digital	(11.8%)	(4.1%)	5.9%	9.3%	10.6%
Memory	(10.3%)	(6.0%)	(2.1%)	(7.4%)	(3.5%)
Logic	(12.1%)	(3.8%)	7.1%	11.5%	12.2%
MOS Digital	25.0%	(2.2%)	19.7%	28.2%	41.3%
Memory	46.6%	(8.1%)	18.0%	28.1%	55.2%
Micro	5.6%	7.8%	21.6%	30.0%	30.9%
Logic	11.3%	0.7%	21.1%	26.8%	27.4%
Analog	8.9%	4.0%	16.4%	20.7%	21.5%
Total Discrete	6.9%	1.4%	10.8%	13.3%	13.7%
Total Optoelectronic	14.8%	3.9%	12.8%	15.8%	17.2%

Source: Dataquest
May 1989

Semiconductor Consumption

Table 1g

Worldwide Semiconductor Market
(Compound Annual Growth Rates)

	CAGR (1978-1983)	CAGR (1983-1988)	CAGR (1988-1993)
Total Semiconductor	16.9%	20.9%	16.7%
Total IC	23.0%	22.7%	18.1%
Bipolar Digital	19.0%	11.5%	1.6%
Memory	N/A	2.1%	(5.9%)
Logic	N/A	13.4%	2.5%
MOS Digital	27.8%	27.5%	21.6%
Memory	N/A	25.5%	25.9%
Micro	N/A	29.2%	18.7%
Logic	N/A	29.1%	17.0%
Analog	17.9%	18.8%	14.1%
Total Discrete	3.2%	14.3%	9.1%
Total Optoelectronic	18.2%	17.1%	12.8%

	CAGR (1993-1998)	CAGR (1978-1988)	CAGR (1988-1998)
Total Semiconductor	16.9%	18.9%	16.8%
Total IC	18.1%	22.8%	18.1%
Bipolar Digital	3.1%	15.2%	2.3%
Memory	(4.1%)	N/A	(5.0%)
Logic	3.6%	N/A	3.1%
MOS Digital	20.4%	27.6%	21.0%
Memory	23.5%	N/A	24.7%
Micro	17.7%	N/A	18.2%
Logic	15.6%	N/A	16.3%
Analog	11.1%	18.3%	12.6%
Total Discrete	7.3%	8.6%	8.2%
Total Optoelectronic	11.4%	17.6%	12.1%

N/A = Not Available

Source: Dataquest
May 1989

Semiconductor Consumption

Table 2a

North American Semiconductor Market
(Millions of Dollars)

	1978	1979	1980	1981	1982
Total Semiconductor	3,506	4,538	6,053	6,529	6,970
Total IC	2,335	3,179	4,562	4,867	5,466
Bipolar Digital	666	901	1,411	1,339	1,367
Memory		185	396	375	320
Logic		716	1,015	964	1,047
MOS Digital	1,099	1,703	2,442	2,595	3,183
Memory		1,028	1,230	1,107	1,592
Micro		186	377	489	641
Logic		489	835	999	950
Analog	570	575	709	933	916
Total Discrete	1,005	1,161	1,269	1,378	1,201
Total Optoelectronic	166	198	222	284	303

Source: Dataquest
May 1989

Semiconductor Consumption

Table 2b

North American Semiconductor Market
(Millions of Dollars)

	1983	1984	1985	1986	1987	1988
Total Semiconductor	9,002	13,006	9,420	10,844	12,845	16,013
Total IC	7,301	11,089	7,757	8,986	10,873	14,008
Bipolar Digital	1,664	2,818	1,926	2,030	2,061	2,033
Memory	373	441	288	267	271	234
Logic	1,291	2,377	1,638	1,763	1,790	1,799
MOS Digital	4,326	6,503	4,322	4,912	6,773	9,777
Memory	2,051	3,426	1,753	1,775	2,520	4,472
Micro	1,034	1,634	1,258	1,362	2,012	2,690
Logic	1,241	1,443	1,311	1,775	2,241	2,615
Analog	1,311	1,768	1,509	2,044	2,039	2,198
Total Discrete	1,353	1,503	1,295	1,542	1,642	1,707
Total Optoelectronic	348	414	368	316	330	298

Source: Dataquest
May 1989

Semiconductor Consumption

Table 2c

North American Semiconductor Market
(Millions of Dollars)

	1989	1990	1991	1992	1993	1998
Total Semiconductor	18,348	17,643	20,304	24,585	33,340	72,317
Total IC	16,278	15,562	18,069	22,175	30,691	68,957
Bipolar Digital	1,609	1,487	1,550	1,597	1,679	1,815
Memory	198	172	170	155	150	127
Logic	1,411	1,315	1,380	1,442	1,529	1,688
MOS Digital	12,326	11,715	13,822	17,423	25,162	60,914
Memory	6,823	6,044	7,072	9,051	14,482	40,771
Micro	2,674	2,906	3,450	4,313	5,606	10,794
Logic	2,829	2,765	3,300	4,059	5,074	9,349
Analog	2,343	2,360	2,697	3,155	3,850	6,228
Total Discrete	1,750	1,751	1,872	2,011	2,189	2,715
Total Optoelectronic	320	330	363	399	460	645

Source: Dataquest
May 1989

Semiconductor Consumption

Table 2d

North American Semiconductor Market
(Percent Change)

	1978	1979	1980	1981	1982
Total Semiconductor	21.9%	29.4%	33.4%	7.9%	6.8%
Total IC	28.9%	36.1%	43.5%	6.7%	12.3%
Bipolar Digital	24.0%	35.3%	56.6%	(5.1%)	2.1%
Memory	N/A	N/A	114.1%	(5.3%)	(14.7%)
Logic	N/A	N/A	41.8%	(5.0%)	8.6%
MOS Digital	32.4%	55.0%	43.4%	6.3%	22.7%
Memory	N/A	N/A	19.6%	(10.0%)	43.8%
Micro	N/A	N/A	102.7%	29.7%	31.1%
Logic	N/A	N/A	70.8%	19.6%	(4.9%)
Analog	28.4%	0.9%	23.3%	31.6%	(1.8%)
Total Discrete	6.9%	15.5%	9.3%	8.6%	(12.8%)
Total Optoelectronic	32.8%	19.3%	12.1%	27.9%	6.7%

N/A = Not Available

Source: Dataquest
May 1989

Semiconductor Consumption

Table 2e

North American Semiconductor Market
(Percent Change)

	1983	1984	1985	1986	1987	1988
Total Semiconductor	29.2%	44.5%	(27.6%)	15.1%	18.5%	24.7%
Total IC	33.6%	51.9%	(30.0%)	15.8%	21.0%	28.8%
Bipolar Digital	21.7%	69.4%	(31.7%)	5.4%	1.5%	(1.4%)
Memory	16.6%	18.2%	(34.7%)	(7.3%)	1.5%	(13.7%)
Logic	23.3%	84.1%	(31.1%)	7.6%	1.5%	0.5%
MOS Digital	35.9%	50.3%	(33.5%)	13.7%	37.9%	44.4%
Memory	28.8%	67.0%	(48.8%)	1.3%	42.0%	77.5%
Micro	61.3%	58.0%	(23.0%)	8.3%	47.7%	33.7%
Logic	30.6%	16.3%	(9.1%)	35.4%	26.3%	16.7%
Analog	43.1%	34.9%	(14.6%)	35.5%	(0.2%)	7.8%
Total Discrete	12.7%	11.1%	(13.8%)	19.1%	6.5%	4.0%
Total Optoelectronic	14.9%	19.0%	(11.1%)	(14.1%)	4.4%	(9.7%)

Source: Dataquest
May 1989

Semiconductor Consumption

Table 2f

North American Semiconductor Market
(Percent Change)

	1989	1990	1991	1992	1993
Total Semiconductor	14.6%	(3.8%)	15.1%	21.1%	35.6%
Total IC	16.2%	(4.4%)	16.1%	22.7%	38.4%
Bipolar Digital	(20.9%)	(7.6%)	4.2%	3.0%	5.1%
Memory	(15.4%)	(13.1%)	(1.2%)	(8.8%)	(3.2%)
Logic	(21.6%)	(6.8%)	4.9%	4.5%	6.0%
MOS Digital	26.1%	(5.0%)	18.0%	26.1%	44.4%
Memory	52.6%	(11.4%)	17.0%	28.0%	60.0%
Micro	(0.6%)	8.7%	18.7%	25.0%	30.0%
Logic	8.2%	(2.3%)	19.3%	23.0%	25.0%
Analog	6.6%	0.7%	14.3%	17.0%	22.0%
Total Discrete	2.5%	0.1%	6.9%	7.4%	8.9%
Total Optoelectronic	7.4%	3.1%	10.0%	9.9%	15.3%

Source: Dataquest
May 1989

Semiconductor Consumption

Table 2g

North American Semiconductor Market
(Compound Annual Growth Rates)

	CAGR (1978-1983)	CAGR (1983-1988)	CAGR (1988-1993)
Total Semiconductor	20.8%	12.2%	15.8%
Total IC	25.6%	13.9%	17.0%
Bipolar Digital	20.1%	4.1%	(3.8%)
Memory	N/A	(8.9%)	(8.5%)
Logic	N/A	6.9%	(3.2%)
MOS Digital	31.5%	17.7%	20.8%
Memory	N/A	16.9%	26.5%
Micro	N/A	21.1%	15.8%
Logic	N/A	16.1%	14.2%
Analog	18.1%	10.9%	11.9%
Total Discrete	6.1%	4.8%	5.1%
Total Optoelectronic	16.0%	(3.1%)	9.1%

	CAGR (1993-1998)	CAGR (1978-1988)	CAGR (1988-1998)
Total Semiconductor	16.7%	16.4%	16.3%
Total IC	17.6%	19.6%	17.3%
Bipolar Digital	1.6%	11.8%	(1.1%)
Memory	(3.3%)	N/A	(5.9%)
Logic	2.0%	N/A	(0.6%)
MOS Digital	19.3%	24.4%	20.1%
Memory	23.0%	N/A	24.7%
Micro	14.0%	N/A	14.9%
Logic	13.0%	N/A	13.6%
Analog	10.1%	14.4%	11.0%
Total Discrete	4.4%	5.4%	4.7%
Total Optoelectronic	7.0%	6.0%	8.0%

N/A = Not Available

Source: Dataquest
May 1989

Semiconductor Consumption

Table 3a

Japanese Semiconductor Market
(Millions of Dollars)

	1978	1979	1980	1981	1982
Total Semiconductor	2,448	2,768	3,383	4,295	4,082
Total IC	1,399	1,738	2,201	2,793	2,855
Bipolar Digital	259	304	345	438	498
Memory		52	57	77	87
Logic		252	288	361	411
MOS Digital	588	762	991	1,174	1,263
Memory		256	423	491	534
Micro		213	269	404	446
Logic		293	299	279	283
Analog	552	672	865	1,181	1,094
Total Discrete	946	889	986	1,237	970
Total Optoelectronic	103	141	196	265	257

Source: Dataquest
May 1989

Semiconductor Consumption

Table 3b

Japanese Semiconductor Market
(Millions of Dollars)

	1983	1984	1985	1986	1987	1988
Total Semiconductor	5,722	8,774	8,149	11,855	14,992	20,332
Total IC	4,167	6,517	5,985	8,802	11,318	15,748
Bipolar Digital	706	955	824	1,295	1,563	1,849
Memory	109	163	136	169	227	318
Logic	597	792	688	1,126	1,336	1,531
MOS Digital	1,948	3,621	3,232	4,762	6,430	10,185
Memory	893	1,579	1,185	1,738	2,268	4,204
Micro	594	979	884	1,368	1,902	2,585
Logic	461	1,063	1,163	1,656	2,260	3,396
Analog	1,513	1,941	1,929	2,745	3,325	3,714
Total Discrete	1,217	1,756	1,621	2,242	2,703	3,202
Total Optoelectronic	338	501	543	811	971	1,382

Source: Dataquest
May 1989

Semiconductor Consumption

Table 3c

Japanese Semiconductor Market
(Millions of Dollars)

	1989	1990	1991	1992	1993	1998
Total Semiconductor	23,366	23,060	26,656	31,931	42,548	88,145
Total IC	18,301	18,045	21,016	25,512	35,088	77,080
Bipolar Digital	1,774	1,708	1,788	1,942	2,179	2,424
Memory	305	297	287	261	248	185
Logic	1,469	1,411	1,501	1,681	1,931	2,239
MOS Digital	12,551	12,254	14,533	18,096	26,427	64,355
Memory	5,823	5,445	6,316	7,895	13,027	36,675
Micro	2,875	2,972	3,540	4,354	5,747	11,813
Logic	3,853	3,837	4,677	5,847	7,653	15,867
Analog	3,976	4,083	4,695	5,474	6,482	10,301
Total Discrete	3,436	3,350	3,742	4,236	4,906	6,564
Total Optoelectronic	1,629	1,665	1,898	2,183	2,554	4,501

Source: Dataquest
May 1989

Semiconductor Consumption

Table 3d

Japanese Semiconductor Market
(Percent Change in Dollars)

	1978	1979	1980	1981	1982
Total Semiconductor	42.1%	13.1%	22.2%	27.0%	(5.0%)
Total IC	61.9%	24.2%	26.6%	26.9%	2.2%
Bipolar Digital	36.3%	17.4%	13.5%	27.0%	13.7%
Memory	N/A	N/A	9.6%	35.1%	13.0%
Logic	N/A	N/A	14.3%	25.3%	13.9%
MOS Digital	87.3%	29.6%	30.1%	18.5%	7.6%
Memory	N/A	N/A	65.2%	16.1%	8.8%
Micro	N/A	N/A	26.3%	50.2%	10.4%
Logic	N/A	N/A	2.0%	(6.7%)	1.4%
Analog	53.3%	21.7%	28.7%	36.5%	(7.4%)
Total Discrete	19.4%	(6.0%)	10.9%	25.5%	(21.6%)
Total Optoelectronic	53.7%	36.9%	39.0%	35.2%	(3.0%)

N/A = Not Available

Source: Dataquest
May 1989

Semiconductor Consumption

Table 3e

Japanese Semiconductor Market
(Percent Change in Dollars)

	1983	1984	1985	1986	1987	1988
Total Semiconductor	40.2%	53.3%	(7.1%)	45.5%	26.5%	35.6%
Total IC	46.0%	56.4%	(8.2%)	47.1%	28.6%	39.1%
Bipolar Digital	41.8%	35.3%	(13.7%)	57.2%	20.7%	18.3%
Memory	25.3%	49.5%	(16.6%)	24.3%	34.3%	40.1%
Logic	45.3%	32.7%	(13.1%)	63.7%	18.7%	14.6%
MOS Digital	54.2%	85.9%	(10.7%)	47.3%	35.0%	58.4%
Memory	67.2%	76.8%	(25.0%)	46.7%	30.5%	85.4%
Micro	33.2%	64.8%	(9.7%)	54.8%	39.0%	35.9%
Logic	62.9%	130.6%	9.4%	42.4%	36.5%	50.3%
Analog	38.3%	28.3%	(0.6%)	42.3%	21.1%	11.7%
Total Discrete	25.5%	44.3%	(7.7%)	38.3%	20.6%	18.5%
Total Optoelectronic	31.5%	48.2%	8.4%	49.4%	19.7%	42.3%

Source: Dataquest
May 1989

Table 3f

Japanese Semiconductor Market
(Percent Change in Dollars)

	1989	1990	1991	1992	1993
Total Semiconductor	14.9%	(1.3%)	15.6%	19.8%	33.2%
Total IC	16.2%	(1.4%)	16.5%	21.4%	37.5%
Bipolar Digital	(4.1%)	(3.7%)	4.7%	8.6%	12.2%
Memory	(4.1%)	(2.6%)	(3.4%)	(9.1%)	(5.0%)
Logic	(4.0%)	(3.9%)	6.4%	12.0%	14.9%
MOS Digital	23.2%	(2.4%)	18.6%	24.5%	46.0%
Memory	38.5%	(6.5%)	16.0%	25.0%	65.0%
Micro	11.2%	3.4%	19.1%	23.0%	32.0%
Logic	13.5%	(0.4%)	21.9%	25.0%	30.9%
Analog	7.1%	2.7%	15.0%	16.6%	18.4%
Total Discrete	7.3%	(2.5%)	11.7%	13.2%	15.8%
Total Optoelectronic	17.9%	2.2%	14.0%	15.0%	17.0%

Source: Dataquest
May 1989

Semiconductor Consumption

Table 3g

Japanese Semiconductor Market
(Compound Annual Growth Rates in U.S. Dollars)

	CAGR (1978-1983)	CAGR (1983-1988)	CAGR (1988-1993)
Total Semiconductor	18.5%	28.9%	15.9%
Total IC	24.4%	30.5%	17.4%
Bipolar Digital	22.2%	21.2%	3.3%
Memory	N/A	23.9%	(4.9%)
Logic	N/A	20.7%	4.8%
MOS Digital	27.1%	39.2%	21.0%
Memory	N/A	36.3%	25.4%
Micro	N/A	34.2%	17.3%
Logic	N/A	49.1%	17.6%
Analog	22.3%	19.7%	11.8%
Total Discrete	5.2%	21.3%	8.9%
Total Optoelectronic	26.8%	32.5%	13.1%

	CAGR (1993-1998)	CAGR (1978-1988)	CAGR (1988-1998)
Total Semiconductor	15.7%	23.6%	15.8%
Total IC	17.0%	27.4%	17.2%
Bipolar Digital	2.2%	21.7%	2.7%
Memory	(5.7%)	N/A	(5.3%)
Logic	3.0%	N/A	3.9%
MOS Digital	19.5%	33.0%	20.2%
Memory	23.0%	N/A	24.2%
Micro	15.5%	N/A	16.4%
Logic	15.7%	N/A	16.7%
Analog	9.7%	21.0%	10.7%
Total Discrete	6.0%	13.0%	7.4%
Total Optoelectronic	12.0%	29.6%	12.5%

N/A = Not Available

Source: Dataquest
May 1989

Semiconductor Consumption

Table 4a

Japanese Semiconductor Market
(Billions of Yen)

	1978	1979	1980	1981	1982
Total Semiconductor	514.1	606.3	768.0	949.3	1,012.3
Total IC	293.8	380.7	499.7	617.3	708.0
Bipolar Digital	54.4	66.6	78.3	96.8	123.5
Memory		11.4	12.9	17.0	21.6
Logic		55.2	65.4	79.8	101.9
MOS Digital	123.5	166.9	225.0	259.5	313.2
Memory		56.1	96.0	108.5	132.4
Micro		46.6	61.1	89.3	110.6
Logic		64.2	67.9	61.7	70.2
Analog	115.9	147.2	196.4	261.0	271.3
Total Discrete	198.7	194.7	223.8	273.4	240.6
Total Optoelectronic	21.6	30.9	44.5	58.6	63.7
Exchange Rate Yen/$	210	219	227	221	248

Source: Dataquest
May 1989

Semiconductor Consumption

Table 4b

Japanese Semiconductor Market
(Billions of Yen)

	1983	1984	1985	1986	1987	1988
Total Semiconductor	1,344.7	2,079.3	1,939.4	1,979.7	2,158.8	2,643.2
Total IC	979.3	1,544.4	1,424.4	1,469.9	1,629.8	2,047.2
Bipolar Digital	165.9	226.3	196.1	216.2	225.1	240.3
Memory	25.6	38.6	32.4	28.2	32.7	41.3
Logic	140.3	187.7	163.7	188.0	192.4	199.0
MOS Digital	457.8	858.1	769.2	795.3	925.9	1,324.1
Memory	209.9	374.2	282.0	290.2	326.6	546.5
Micro	139.6	232.0	210.4	228.5	273.9	336.1
Logic	108.3	251.9	276.8	276.6	325.4	441.5
Analog	355.6	460.0	459.1	458.4	478.8	482.8
Total Discrete	286.0	416.2	385.8	374.4	389.2	416.3
Total Optoelectronic	79.4	118.7	129.2	135.4	139.8	179.7
Exchange Rate Yen/$	235	237	238	167	144	130

Source: Dataquest
May 1989

Table 4c

Japanese Semiconductor Market
(Billions of Yen)

	1989	1990	1991	1992	1993	1998
Total Semiconductor	2,990.7	2,951.6	3,411.9	4,087.2	5,446.2	11,282.6
Total IC	2,342.4	2,309.7	2,690.0	3,265.6	4,491.3	9,866.3
Bipolar Digital	227.0	218.6	228.8	248.6	278.9	310.3
Memory	39.0	38.0	36.7	33.4	31.7	23.7
Logic	188.0	180.6	192.1	215.2	247.2	286.6
MOS Digital	1,606.5	1,568.5	1,860.2	2,316.3	3,382.7	8,237.5
Memory	745.3	697.0	808.4	1,010.6	1,667.5	4,694.4
Micro	368.0	380.4	453.1	557.3	735.6	1,512.1
Logic	493.2	491.1	598.7	748.4	979.6	2,031.0
Analog	508.9	522.6	601.0	700.7	829.7	1,318.5
Total Discrete	439.8	428.8	479.0	542.2	628.0	840.2
Total Optoelectronic	208.5	213.1	242.9	279.4	326.9	576.1
Exchange Rate Yen/$	128	128	128	128	128	128

Source: Dataquest
May 1989

Table 4d

Japanese Semiconductor Market
(Percent Change in Yen)

	1978	1979	1980	1981	1982
Total Semiconductor	10.9%	17.9%	26.7%	23.6%	6.6%
Total IC	26.4%	29.6%	31.3%	23.5%	14.7%
Bipolar Digital	6.4%	22.4%	17.6%	23.6%	27.6%
Memory	N/A	N/A	13.2%	31.8%	27.1%
Logic	N/A	N/A	18.5%	22.0%	27.7%
MOS Digital	46.2%	35.2%	34.8%	15.3%	20.7%
Memory	N/A	N/A	71.1%	13.0%	22.0%
Micro	N/A	N/A	31.1%	46.2%	23.9%
Logic	N/A	N/A	5.8%	(9.1%)	13.8%
Analog	19.7%	27.0%	33.4%	32.9%	3.9%
Total Discrete	(6.8%)	(2.0%)	14.9%	22.2%	(12.0%)
Total Optoelectronic	20.0%	42.9%	44.0%	31.7%	8.7%

N/A = Not Available

Source: Dataquest
May 1989

Semiconductor Consumption

Table 4e

Japanese Semiconductor Market
(Percent Change in Yen)

	1983	1984	1985	1986	1987	1988
Total Semiconductor	32.8%	54.6%	(6.7%)	2.1%	9.0%	22.4%
Total IC	38.3%	57.7%	(7.8%)	3.2%	10.9%	25.6%
Bipolar Digital	34.3%	36.4%	(13.3%)	10.2%	4.1%	6.8%
Memory	18.5%	50.8%	(16.1%)	(13.0%)	16.0%	26.3%
Logic	37.7%	33.8%	(12.8%)	14.8%	2.3%	3.4%
MOS Digital	46.2%	87.4%	(10.4%)	3.4%	16.4%	43.0%
Memory	58.5%	78.3%	(24.6%)	2.9%	12.5%	67.3%
Micro	26.2%	66.2%	(9.3%)	8.6%	19.9%	22.7%
Logic	54.3%	132.6%	9.9%	(0.1%)	17.6%	35.7%
Analog	31.1%	29.4%	(0.2%)	(0.2%)	4.5%	0.8%
Total Discrete	18.9%	45.5%	(7.3%)	(3.0%)	4.0%	7.0%
Total Optoelectronic	24.6%	49.5%	8.8%	4.8%	3.2%	28.5%

Source: Dataquest
May 1989

Semiconductor Consumption

Table 4f

Japanese Semiconductor Market
(Percent Change in Yen)

	1988	1989	1990	1991	1992	1993
Total Semiconductor	22.4%	13.1%	(1.3%)	15.6%	19.8%	33.3%
Total IC	25.6%	14.4%	(1.4%)	16.5%	21.4%	37.5%
Bipolar Digital	6.8%	(5.5%)	(3.7%)	4.7%	8.7%	12.2%
Memory	26.3%	(5.6%)	(2.6%)	(3.4%)	(9.0%)	(5.1%)
Logic	3.4%	(5.5%)	(3.9%)	6.4%	12.0%	14.9%
MOS Digital	43.0%	21.3%	(2.4%)	18.6%	24.5%	46.0%
Memory	67.3%	36.4%	(6.5%)	16.0%	25.0%	65.0%
Micro	22.7%	9.5%	3.4%	19.1%	23.0%	32.0%
Logic	35.7%	11.7%	(0.4%)	21.9%	25.0%	30.9%
Analog	0.8%	5.4%	2.7%	15.0%	16.6%	18.4%
Total Discrete	7.0%	5.6%	(2.5%)	11.7%	13.2%	15.8%
Total Optoelectronic	28.5%	16.0%	2.2%	14.0%	15.0%	17.0%

Source: Dataquest
May 1989

Semiconductor Consumption

Table 4g

Japanese Semiconductor Market
(Compound Annual Growth Rate in Yen)

	CAGR (1978-1983)	CAGR (1983-1988)	CAGR (1988-1993)
Total Semiconductor	21.2%	14.5%	15.6%
Total IC	27.2%	15.9%	17.0%
Bipolar Digital	25.0%	7.7%	3.0%
Memory	N/A	10.0%	(5.2%)
Logic	N/A	7.2%	4.4%
MOS Digital	30.0%	23.7%	20.6%
Memory	N/A	21.1%	25.0%
Micro	N/A	19.2%	17.0%
Logic	N/A	32.5%	17.3%
Analog	25.1%	6.3%	11.4%
Total Discrete	7.6%	7.8%	8.6%
Total Optoelectronic	29.7%	17.7%	12.7%

	CAGR (1993-1998)	CAGR (1978-1988)	CAGR (1988-1998)
Total Semiconductor	15.7%	17.8%	15.6%
Total IC	17.0%	21.4%	17.0%
Bipolar Digital	2.2%	16.0%	2.6%
Memory	(5.7%)	N/A	(5.4%)
Logic	N/A	N/A	3.7%
MOS Digital	19.5%	26.8%	20.1%
Memory	23.0%	N/A	24.0%
Micro	N/A	N/A	16.2%
Logic	N/A	N/A	16.5%
Analog	9.7%	15.3%	10.6%
Total Discrete	6.0%	7.7%	7.3%
Total Optoelectronic	12.0%	23.6%	12.4%

N/A = Not Available

Source: Dataquest
May 1989

Semiconductor Consumption

Table 5a

Western European Semiconductor Market
(Millions of Dollars)

	1978	1979	1980	1981	1982
Total Semiconductor	2,339	3,018	3,686	3,041	3,167
Total IC	1,238	1,747	2,333	1,892	1,988
Bipolar Digital	291	390	510	454	434
Memory		85	116	103	100
Logic		305	394	351	334
MOS Digital	535	781	1,139	882	948
Memory		367	543	426	469
Micro		125	189	149	168
Logic		289	407	307	311
Analog	412	576	684	556	606
Total Discrete	1,004	1,138	1,192	995	1,011
Total Optoelectronic	97	133	161	154	168

Source: Dataquest
May 1989

Semiconductor Consumption

Table 5b

Western European Semiconductor Market
(Millions of Dollars)

	1983	1984	1985	1986	1987	1988
Total Semiconductor	3,370	4,907	4,839	5,587	6,480	8,491
Total IC	2,323	3,752	3,634	4,116	4,823	6,676
Bipolar Digital	483	741	719	719	727	802
Memory	107	144	150	147	88	85
Logic	376	597	569	572	639	717
MOS Digital	1,227	2,146	1,952	2,270	2,744	4,322
Memory	581	990	749	813	848	1,742
Micro	239	476	489	574	799	1,208
Logic	407	680	714	883	1,097	1,372
Analog	613	865	963	1,127	1,352	1,552
Total Discrete	866	955	981	1,207	1,377	1,506
Total Optoelectronic	181	200	224	264	280	309

Source: Dataquest
May 1989

Semiconductor Consumption

Table 5c

Western European Semiconductor Market
(Millions of Dollars)

	1989	1990	1991	1992	1993	1998
Total Semiconductor	9,357	9,594	11,126	14,564	17,135	33,688
Total IC	7,394	7,532	8,889	11,907	14,208	29,287
Bipolar Digital	661	632	697	859	976	1,159
Memory	59	57	57	59	57	53
Logic	602	575	640	800	919	1,106
MOS Digital	5,041	5,090	6,095	8,320	10,138	22,772
Memory	2,335	2,165	2,585	3,469	4,509	10,760
Micro	1,275	1,443	1,740	2,462	2,905	6,993
Logic	1,431	1,482	1,770	2,389	2,724	5,019
Analog	1,692	1,810	2,097	2,728	3,094	5,356
Total Discrete	1,629	1,684	1,833	2,164	2,356	3,520
Total Optoelectronic	334	378	404	493	571	881

Source: Dataquest
May 1989

Semiconductor Consumption

Table 5d

Western European Semiconductor Market
(Percent Change)

	1978	1979	1980	1981	1982
Total Semiconductor	24.0%	29.0%	22.1%	(17.5%)	4.1%
Total IC	36.9%	41.1%	33.5%	(18.9%)	5.1%
Bipolar Digital	27.6%	34.0%	30.8%	(11.0%)	(4.4%)
Memory	N/A	N/A	36.5%	(11.2%)	(2.9%)
Logic	N/A	N/A	29.2%	(10.9%)	(4.8%)
MOS Digital	52.0%	46.0%	45.8%	(22.6%)	7.5%
Memory	N/A	N/A	48.0%	(21.5%)	10.1%
Micro	N/A	N/A	51.2%	(21.2%)	12.8%
Logic	N/A	N/A	40.8%	(24.6%)	1.3%
Analog	27.2%	39.8%	18.8%	(18.7%)	9.0%
Total Discrete	9.8%	13.3%	4.7%	(16.5%)	1.6%
Total Optoelectronic	42.6%	37.1%	21.1%	(4.3%)	9.1%

N/A = Not Available

Source: Dataquest
May 1989

Semiconductor Consumption

Table 5e

Western European Semiconductor Market
(Percent Change)

	1983	1984	1985	1986	1987	1988
Total Semiconductor	6.4%	45.6%	(1.4%)	15.5%	16.0%	31.0%
Total IC	16.9%	61.5%	(3.1%)	13.3%	17.2%	38.4%
Bipolar Digital	11.3%	53.4%	(3.0%)	0	1.1%	10.3%
Memory	7.0%	34.6%	4.2%	(2.0%)	(40.1%)	(3.4%)
Logic	12.6%	58.8%	(4.7%)	0.5%	11.7%	12.2%
MOS Digital	29.4%	74.9%	(9.0%)	16.3%	20.9%	57.5%
Memory	23.9%	70.4%	(24.3%)	8.5%	4.3%	105.4%
Micro	42.3%	99.2%	2.7%	17.4%	39.2%	51.2%
Logic	30.9%	67.1%	5.0%	23.7%	24.2%	25.1%
Analog	1.2%	41.1%	11.3%	17.0%	20.0%	14.8%
Total Discrete	(14.3%)	10.3%	2.7%	23.0%	14.1%	9.4%
Total Optoelectronic	7.7%	10.5%	12.0%	17.9%	6.1%	10.4%

Source: Dataquest
May 1989

Semiconductor Consumption

Table 5f

Western European Semiconductor Market
(Percent Change)

	1989	1990	1991	1992	1993
Total Semiconductor	10.2%	2.5%	16.0%	30.9%	17.7%
Total IC	10.8%	1.9%	18.0%	34.0%	19.3%
Bipolar Digital	(17.6%)	(4.4%)	10.3%	23.2%	13.6%
Memory	(30.6%)	(3.4%)	0	3.5%	(3.4%)
Logic	(16.0%)	(4.5%)	11.3%	25.0%	14.9%
MOS Digital	16.6%	1.0%	19.7%	36.5%	21.9%
Memory	34.0%	(7.3%)	19.4%	34.2%	30.0%
Micro	5.5%	13.2%	20.6%	41.5%	18.0%
Logic	4.3%	3.6%	19.4%	35.0%	14.0%
Analog	9.0%	7.0%	15.9%	30.1%	13.4%
Total Discrete	8.2%	3.4%	8.8%	18.1%	8.9%
Total Optoelectronic	8.1%	13.2%	6.9%	22.0%	15.8%

Source: Dataquest
May 1989

Table 5g

Western European Semiconductor Market
(Compound Annual Growth Rates)

	CAGR (1978-1983)	CAGR (1983-1988)	CAGR (1988-1993)
Total Semiconductor	7.6%	20.3%	15.1%
Total IC	13.4%	23.5%	16.3%
Bipolar Digital	10.7%	10.7%	4.0%
Memory	N/A	(4.5%)	(7.7%)
Logic	N/A	13.8%	5.1%
MOS Digital	18.1%	28.6%	18.6%
Memory	N/A	24.6%	21.0%
Micro	N/A	38.3%	19.2%
Logic	N/A	27.5%	14.7%
Analog	8.3%	20.4%	14.8%
Total Discrete	(2.9%)	11.7%	9.4%
Total Optoelectronic	13.3%	11.3%	13.1%

	CAGR (1993-1998)	CAGR (1978-1988)	CAGR (1988-1998)
Total Semiconductor	14.5%	13.8%	14.8%
Total IC	15.6%	18.4%	15.9%
Bipolar Digital	3.5%	10.7%	3.8%
Memory	(1.4%)	N/A	(4.6%)
Logic	N/A	N/A	4.4%
MOS Digital	17.6%	23.2%	18.1%
Memory	19.0%	N/A	20.0%
Micro	N/A	N/A	19.2%
Logic	N/A	N/A	13.8%
Analog	11.6%	14.2%	13.2%
Total Discrete	8.4%	4.1%	8.9%
Total Optoelectronic	9.1%	12.3%	11.0%

N/A = Not Available

Source: Dataquest
May 1989

Semiconductor Consumption

Table 6a

Rest of World Semiconductor Market
(Millions of Dollars)

	1978	1979	1980	1981	1982
Total Semiconductor	660	790	996	963	1,042
Total IC	258	364	450	494	585
Bipolar Digital	45	79	108	106	113
Memory		2	3	3	4
Logic		77	105	103	109
MOS Digital	110	100	143	171	248
Memory		25	34	51	106
Micro		17	27	43	63
Logic		58	82	77	79
Analog	103	185	199	217	224
Total Discrete	346	334	436	375	365
Total Optoelectronic	56	92	110	94	92

Source: Dataquest
May 1989

Semiconductor Consumption

Table 6b

Rest of World Semiconductor Market
(Millions of Dollars)

	1983	1984	1985	1986	1987	1988
Total Semiconductor	1,443	2,216	1,949	2,548	3,961	5,650
Total IC	909	1,328	1,179	1,714	2,890	4,368
Bipolar Digital	162	257	203	281	411	513
Memory	14	26	15	23	35	33
Logic	148	231	188	258	376	480
MOS Digital	450	700	616	871	1,541	2,496
Memory	194	234	134	185	445	1,153
Micro	112	145	117	185	386	644
Logic	144	321	365	501	710	699
Analog	297	371	360	562	938	1,359
Total Discrete	429	773	679	739	943	1,128
Total Optoelectronic	105	115	91	95	128	154

Source: Dataquest
May 1989

Semiconductor Consumption

Table 6c

Rest of World Semiconductor Market
(Millions of Dollars)

	1989	1990	1991	1992	1993	1998
Total Semiconductor	7,133	7,593	9,374	11,954	16,337	44,281
Total IC	5,706	6,013	7,541	9,833	13,780	39,759
Bipolar Digital	538	567	619	687	789	1,137
Memory	39	39	39	37	39	35
Logic	499	528	580	650	750	1,102
MOS Digital	3,568	3,702	4,776	6,464	9,366	31,689
Memory	1,981	1,928	2,410	3,135	4,543	16,868
Micro	702	794	1,140	1,706	2,543	8,402
Logic	885	980	1,226	1,623	2,280	6,419
Analog	1,600	1,744	2,146	2,682	3,625	6,933
Total Discrete	1,249	1,395	1,613	1,855	2,226	3,836
Total Optoelectronic	178	185	220	266	331	686

Source: Dataquest
May 1989

Semiconductor Consumption

Table 6d

Rest of World Semiconductor Market
(Percent Change)

	1978	1979	1980	1981	1982
Total Semiconductor	36.6%	19.7%	26.1%	(3.3%)	8.2%
Total IC	40.2%	41.1%	23.6%	9.8%	18.4%
Bipolar Digital	15.4%	75.6%	36.7%	(1.9%)	6.6%
Memory	N/A	N/A	50.0%	0	33.3%
Logic	N/A	N/A	36.4%	(1.9%)	5.8%
MOS Digital	25.0%	(9.1%)	43.0%	19.6%	45.0%
Memory	N/A	N/A	36.0%	50.0%	107.8%
Micro	N/A	N/A	58.8%	59.3%	46.5%
Logic	N/A	N/A	41.4%	(6.1%)	2.6%
Analog	80.7%	79.6%	7.6%	9.0%	3.2%
Total Discrete	34.6%	(3.5%)	30.5%	(14.0%)	(2.7%)
Total Optoelectronic	33.3%	64.3%	19.6%	(14.5%)	(2.1%)

N/A = Not Available

Source: Dataquest
May 1989

Semiconductor Consumption

Table 6e

Rest of World Semiconductor Market
(Percent Change)

	1983	1984	1985	1986	1987	1988
Total Semiconductor	38.5%	53.6%	(12.0%)	30.7%	55.5%	42.6%
Total IC	55.4%	46.1%	(11.2%)	45.4%	68.6%	51.1%
Bipolar Digital	43.4%	58.6%	(21.0%)	38.4%	46.3%	24.8%
Memory	250.0%	85.7%	(42.3%)	53.3%	52.2%	(5.7%)
Logic	35.8%	56.1%	(18.6%)	37.2%	45.7%	27.7%
MOS Digital	81.5%	55.6%	(12.0%)	41.4%	76.9%	62.0%
Memory	83.0%	20.6%	(42.7%)	38.1%	140.5%	159.1%
Micro	77.8%	29.5%	(19.3%)	58.1%	108.6%	66.8%
Logic	82.3%	122.9%	13.7%	37.3%	41.7%	(1.5%)
Analog	32.6%	24.9%	(3.0%)	56.1%	66.9%	44.9%
Total Discrete	17.5%	80.2%	(12.2%)	8.8%	27.6%	19.6%
Total Optoelectronic	14.1%	9.5%	(20.9%)	4.4%	34.7%	20.3%

Source: Dataquest
May 1989

Semiconductor Consumption

Table 6f

Rest of World Semiconductor Market
(Percent Change)

	1989	1990	1991	1992	1993
Total Semiconductor	26.2%	6.4%	23.5%	27.5%	36.7%
Total IC	30.6%	5.4%	25.4%	30.4%	40.1%
Bipolar Digital	4.9%	5.4%	9.2%	11.0%	14.8%
Memory	18.2%	0	0	(5.1%)	5.4%
Logic	4.0%	5.8%	9.8%	12.1%	15.4%
MOS Digital	42.9%	3.8%	29.0%	35.3%	44.9%
Memory	71.8%	(2.7%)	25.0%	30.1%	44.9%
Micro	9.0%	13.1%	43.6%	49.6%	49.1%
Logic	26.6%	10.7%	25.1%	32.4%	40.5%
Analog	17.7%	9.0%	23.1%	25.0%	35.2%
Total Discrete	10.7%	11.7%	15.6%	15.0%	20.0%
Total Optoelectronic	15.6%	3.9%	18.9%	20.9%	24.4%

Source: Dataquest
May 1989

Semiconductor Consumption

Table 6g

Rest of World Semiconductor Market
(Compound Annual Growth Rates)

	CAGR (1978-1983)	CAGR (1983-1988)	CAGR (1988-1993)
Total Semiconductor	16.9%	31.4%	23.7%
Total IC	28.6%	36.9%	25.8%
Bipolar Digital	29.2%	25.9%	9.0%
Memory	N/A	18.7%	3.4%
Logic	N/A	26.5%	9.3%
MOS Digital	32.5%	40.9%	30.3%
Memory	N/A	42.8%	31.6%
Micro	N/A	41.9%	31.6%
Logic	N/A	37.2%	26.7%
Analog	23.6%	35.5%	21.7%
Total Discrete	4.4%	21.3%	14.6%
Total Optoelectronic	13.4%	8.0%	16.5%

	CAGR (1993-1998)	CAGR (1978-1988)	CAGR (1988-1998)
Total Semiconductor	22.1%	24.0%	22.9%
Total IC	23.6%	32.7%	24.7%
Bipolar Digital	7.6%	27.6%	8.3%
Memory	(2.1%)	N/A	0.6%
Logic	8.0%	N/A	8.7%
MOS Digital	27.6%	36.6%	28.9%
Memory	30.0%	N/A	30.8%
Micro	27.0%	N/A	29.3%
Logic	23.0%	N/A	24.8%
Analog	13.8%	29.4%	17.7%
Total Discrete	11.5%	12.5%	13.0%
Total Optoelectronic	15.7%	10.6%	16.1%

N/A = Not Available

Source: Dataquest
May 1989

Semiconductor Consumption

Table 7a

Worldwide Average Selling Prices (Dollars)

	1978	1979	1980	1981	1982
Total Semiconductor	0.28	0.29	0.33	0.31	0.33
Total IC	1.01	0.97	1.07	1.02	0.99
Bipolar Digital	0.63	0.57	0.70	0.70	0.62
Memory					
Logic					
MOS Digital	1.91	1.93	1.81	1.66	1.63
Memory		5.15	4.90	3.17	2.62
Micro		3.96	3.61	3.40	3.26
Logic		0.89	0.85	0.86	0.80
Analog	0.84	0.78	0.83	0.81	0.79
Total Discrete	0.13	0.12	0.12	0.11	0.11
Total Optoelectronic	0.47	0.51	0.44	0.39	0.29

Source: Dataquest
May 1989

Semiconductor Consumption

Table 7b

Worldwide Average Selling Prices
(Dollars)

	1983	1984	1985	1986	1987	1988
Total Semiconductor	0.32	0.36	0.30	0.34	0.33	0.42
Total IC	1.03	1.10	1.05	1.09	1.18	1.39
Bipolar Digital	0.65	0.65	0.71	0.71	0.69	0.70
Memory						
Logic						
MOS Digital	1.66	1.95	1.64	1.63	1.94	2.36
Memory	2.79	3.90	2.59	2.41	3.09	4.70
Micro	3.35	3.53	3.14	3.13	3.56	4.15
Logic	0.79	0.85	0.93	0.99	1.12	1.13
Analog	0.76	0.75	0.76	0.84	0.82	0.84
Total Discrete	0.09	0.09	0.08	0.09	0.08	0.09
Total Optoelectronic	0.28	0.28	0.22	0.25	0.28	0.34

Source: Dataquest
May 1989

Semiconductor Consumption

Table 7c

Worldwide Average Selling Prices (Dollars)

	1989	1990	1991	1992	1993	1998
Total Semiconductor	0.42	0.41	0.47	0.50	0.57	0.81
Total IC	1.54	1.47	1.54	1.64	1.83	2.31
Bipolar Digital	0.70	0.69	0.70	0.72	0.70	0.69
Memory						
Logic						
MOS Digital	2.62	2.44	2.54	2.69	3.08	3.59
Memory	6.25	5.51	5.95	6.83	8.79	8.53
Micro	4.12	4.10	4.10	4.12	4.18	4.15
Logic	1.09	1.05	1.10	1.15	1.19	1.28
Analog	0.83	0.82	0.84	0.84	0.85	0.86
Total Discrete	0.08	0.08	0.09	0.09	0.09	0.09
Total Optoelectronic	0.34	0.34	0.36	0.38	0.38	0.40

Source: Dataquest
May 1989

Semiconductor Consumption

Table 7d

Worldwide Average Selling Prices
(Percent Change in Dollars)

	1978	1979	1980	1981	1982
Total Semiconductor	2.5%	3.6%	11.7%	(6.4%)	7.5%
Total IC	(0.5%)	(4.0%)	9.8%	(3.9%)	(2.8%)
Bipolar Digital	(4.5%)	(9.5%)	22.8%	0	(11.4%)
Memory					
Logic					
MOS Digital	(7.3%)	1.2%	(6.3%)	(8.4%)	(1.8%)
Memory			(4.9%)	(35.3%)	(17.4%)
Micro			(8.8%)	(5.8%)	(4.1%)
Logic			(4.5%)	1.2%	(7.0%)
Analog	1.2%	(7.1%)	6.4%	(2.4%)	(2.5%)
Total Discrete	(7.1%)	(7.7%)	0	(8.3%)	0
Total Optoelectronic	4.4%	8.0%	(12.8%)	(11.9%)	(25.6%)

Source: Dataquest
May 1989

Table 7e

Worldwide Average Selling Prices
(Percent Change in Dollars)

	1983	1984	1985	1986	1987	1988
Total Semiconductor	(3.0%)	11.8%	(15.7%)	13.2%	(2.7%)	26.7%
Total IC	3.1%	7.5%	(4.4%)	3.5%	8.5%	17.8%
Bipolar Digital	4.8%	0	9.2%	0	(2.8%)	1.4%
Memory						
Logic						
MOS Digital	2.2%	17.3%	(16.0%)	(0.5%)	18.6%	22.1%
Memory	6.5%	39.8%	(33.6%)	(6.9%)	28.2%	52.1%
Micro	2.8%	5.4%	(11.0%)	(0.3%)	13.7%	16.6%
Logic	(1.3%)	7.6%	9.4%	6.5%	13.1%	0.9%
Analog	(3.8%)	(1.3%)	1.3%	10.5%	(2.4%)	2.4%
Total Discrete	(18.2%)	0	(11.1%)	15.0%	(13.0%)	12.5%
Total Optoelectronic	(3.4%)	0	(21.4%)	13.6%	12.0%	21.4%

Source: Dataquest
May 1989

Semiconductor Consumption

Table 7f

Worldwide Average Selling Prices
(Percent Change in Dollars)

	1989	1990	1991	1992	1993
Total Semiconductor	(1.0%)	(2.5%)	14.2%	7.7%	13.9%
Total IC	10.6%	(4.4%)	4.7%	6.0%	12.0%
Bipolar Digital	0	(1.4%)	1.4%	2.9%	(2.8%)
Memory					
Logic					
MOS Digital	10.7%	(6.9%)	4.0%	6.3%	14.3%
Memory	33.0%	(11.8%)	8.0%	14.8%	28.7%
Micro	(0.7%)	(0.5%)	0	0.5%	1.5%
Logic	(3.5%)	(3.7%)	4.8%	4.5%	3.5%
Analog	(1.2%)	(1.2%)	2.4%	0	1.2%
Total Discrete	(11.1%)	0	12.5%	0	0
Total Optoelectronic	0	0	5.9%	5.6%	0

Source: Dataquest
May 1989

Semiconductor Consumption

Table 7g

Worldwide Average Selling Prices
(Compound Annual Growth Rate in Dollars)

	CAGR (1978-1983)	CAGR (1983-1988)	CAGR (1988-1993)
Total Semiconductor	2.5%	5.6%	6.2%
Total IC	0.3%	6.3%	5.6%
Bipolar Digital	0.6%	1.5%	0
Memory	N/A	N/A	N/A
Logic	N/A	N/A	N/A
MOS Digital	(2.7%)	7.3%	5.4%
Memory	N/A	11.0%	13.3%
Micro	N/A	4.4%	0.1%
Logic	N/A	7.4%	1.0%
Analog	(2.0%)	2.0%	0.2%
Total Discrete	(7.1%)	0	0
Total Optoelectronic	(9.8%)	4.0%	2.2%

	CAGR (1993-1998)	CAGR (1978-1988)	CAGR (1988-1998)
Total Semiconductor	7.2%	4.0%	6.7%
Total IC	4.7%	3.3%	5.2%
Bipolar Digital	(0.3%)	1.1%	(0.1%)
Memory	N/A	N/A	N/A
Logic	N/A	N/A	N/A
MOS Digital	3.1%	2.2%	4.3%
Memory	(0.6%)	N/A	6.1%
Micro	(0.1%)	N/A	0
Logic	1.5%	N/A	1.3%
Analog	0.2%	0	0.2%
Total Discrete	0	(3.6%)	0
Total Optoelectronic	1.0%	(3.2%)	1.6%

N/A = Not Available

Source: Dataquest
May 1989

Semiconductor Consumption

Table 8a

Worldwide Semiconductor Market
(Millions of Units)

	1978	1979	1980	1981	1982
Total Semiconductor	31,461	37,703	42,870	48,081	46,022
Total IC	5,171	7,242	8,955	9,809	10,949
Bipolar Digital	2,002	2,937	3,391	3,339	3,890
Memory					
Logic					
MOS Digital	1,221	1,731	2,603	2,906	3,464
Memory		325	455	655	1,031
Micro		137	239	319	404
Logic		1,269	1,909	1,933	2,029
Analog	1,949	2,574	2,960	3,564	3,595
Total Discrete	25,392	29,350	32,358	36,227	32,245
Total Optoelectronic	898	1,111	1,557	2,045	2,828

Source: Dataquest
May 1989

Semiconductor Consumption

Table 8b

Worldwide Semiconductor Market
(Millions of Units)

	1983	1984	1985	1986	1987	1988
Total Semiconductor	60,743	80,377	80,380	89,881	114,684	119,373
Total IC	14,327	20,573	17,607	21,654	25,268	29,259
Bipolar Digital	4,638	7,340	5,172	6,092	6,901	7,424
Memory						
Logic						
MOS Digital	4,776	6,639	6,171	7,850	9,032	11,331
Memory	1,333	1,597	1,475	1,872	1,968	2,462
Micro	591	916	875	1,115	1,432	1,717
Logic	2,852	4,126	3,820	4,864	5,632	7,152
Analog	4,913	6,593	6,264	7,712	9,334	10,504
Total Discrete	42,944	55,411	57,200	62,283	83,313	83,811
Total Optoelectronic	3,471	4,393	5,573	5,944	6,104	6,303

Source: Dataquest
May 1989

Semiconductor Consumption

Table 8c

Worldwide Semiconductor Market
(Millions of Units)

	1989	1990	1991	1992	1993	1998
Total Semiconductor	138,959	141,773	144,653	165,301	191,222	294,708
Total IC	30,921	31,999	35,972	42,442	51,172	93,092
Bipolar Digital	6,546	6,368	6,649	7,063	8,033	9,471
Memory						
Logic						
MOS Digital	12,796	13,440	15,472	18,666	23,079	50,111
Memory	2,714	2,828	3,090	3,448	4,159	12,318
Micro	1,827	1,979	2,407	3,115	4,019	9,157
Logic	8,255	8,632	9,975	12,103	14,900	28,636
Analog	11,580	12,191	13,851	16,713	20,060	33,509
Total Discrete	100,800	102,250	100,667	114,067	129,744	184,833
Total Optoelectronic	7,238	7,524	8,014	8,792	10,305	16,783

Source: Dataquest
May 1989

Semiconductor Consumption

Table 8d

Worldwide Semiconductor Market
(Percent Change in Units)

	1978	1979	1980	1981	1982
Total Semiconductor	25%	20%	14%	12%	(4%)
Total IC	40%	40%	24%	10%	12%
Bipolar Digital	33%	47%	15%	(2%)	17%
Memory					
Logic					
MOS Digital	59%	42%	50%	12%	19%
Memory			40%	44%	57%
Micro			75%	34%	27%
Logic			51%	1%	5%
Analog	36%	32%	15%	20%	1%
Total Discrete	22%	16%	10%	12%	(11%)
Total Optoelectronic	34%	24%	40%	31%	38%

Source: Dataquest
May 1989

Semiconductor Consumption

Table 8e

Worldwide Semiconductor Market
(Percent Change in Units)

	1983	1984	1985	1986	1987	1988
Total Semiconductor	32%	32%	0	12%	28%	4%
Total IC	31%	44%	(14%)	23%	17%	16%
Bipolar Digital	19%	58%	(30%)	18%	13%	8%
Memory						
Logic						
MOS Digital	38%	39%	(7%)	27%	15%	25%
Memory	29%	20%	(8%)	27%	5%	25%
Micro	46%	55%	(4%)	27%	28%	20%
Logic	41%	45%	(7%)	27%	16%	27%
Analog	37%	34%	(5%)	23%	21%	13%
Total Discrete	33%	29%	3%	9%	34%	1%
Total Optoelectronic	23%	27%	27%	7%	3%	3%

Source: Dataquest
May 1989

Semiconductor Consumption

Table 8f

Worldwide Semiconductor Market
(Percent Change in Units)

	1989	1990	1991	1992	1993
Total Semiconductor	16%	2%	2%	14%	16%
Total IC	6%	3%	12%	18%	21%
Bipolar Digital	(12%)	(3%)	4%	6%	14%
Memory					
Logic					
MOS Digital	13%	5%	15%	21%	24%
Memory	10%	4%	9%	12%	21%
Micro	6%	8%	22%	29%	29%
Logic	15%	5%	16%	21%	23%
Analog	10%	5%	14%	21%	20%
Total Discrete	20%	1%	(2%)	13%	14%
Total Optoelectronic	15%	4%	7%	10%	17%

Source: Dataquest
May 1989

Semiconductor Consumption

Table 8g

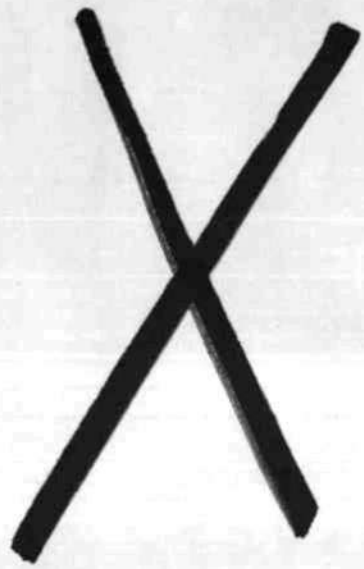
Worldwide Semiconductor Market
(Compound Annual Growth Rate in Millions of Units)

	CAGR (1978-1983)	CAGR (1983-1988)	CAGR (1988-1993)
Total Semiconductor	14.1%	14.5%	9.9%
Total IC	22.6%	15.4%	11.8%
Bipolar Digital	18.3%	9.9%	1.6%
Memory	N/A	N/A	N/A
Logic	N/A	N/A	N/A
MOS Digital	31.4%	18.9%	15.3%
Memory	N/A	13.1%	11.1%
Micro	N/A	23.8%	18.5%
Logic	N/A	20.2%	15.8%
Analog	20.3%	16.4%	13.8%
Total Discrete	11.1%	14.3%	9.1%
Total Optoelectronic	31.1%	12.7%	10.3%

	CAGR (1993-1998)	CAGR (1978-1988)	CAGR (1988-1998)
Total Semiconductor	9.0%	14.3%	9.5%
Total IC	12.7%	18.9%	12.3%
Bipolar Digital	3.3%	14.0%	2.5%
Memory	N/A	N/A	N/A
Logic	N/A	N/A	N/A
MOS Digital	16.8%	25.0%	16.0%
Memory	24.3%	N/A	17.5%
Micro	17.9%	N/A	18.2%
Logic	14.0%	N/A	14.9%
Analog	10.8%	18.3%	12.3%
Total Discrete	7.3%	12.7%	8.2%
Total Optoelectronic	10.2%	21.5%	10.3%

N/A = Not Available

Source: Dataquest
May 1989



Nielsen Dataquest RESEARCH NEWSLETTER

SIS Code: Vol. III, Appendix A

APPENDIX A—MARKET ESTIMATES

SUMMARY

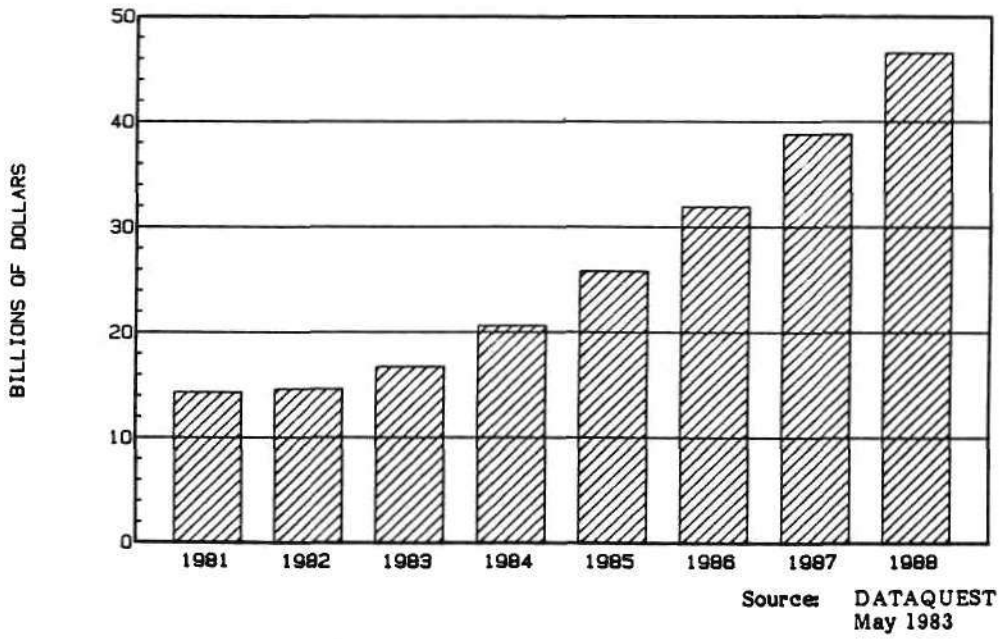
This newsletter summarizes the statistics contained in Appendix A of your Semiconductor Industry Service Volume III.

DATAQUEST estimates that worldwide semiconductor consumption was $14,616 million in 1982. Of this total, U.S. companies produced an estimated $6,201 million, or 42 percent of the total; Japanese companies manufactured an estimated $5,018 million, or 34 percent of the total; and West European companies produced $2,822 million, or 19 percent of the total.

DATAQUEST forecasts a 15 percent increase in worldwide consumption in 1983, with continuing growth through 1988 (see Figure 1). The compound annual growth rate between 1982 and 1988 is expected to be 21 percent.

Figure 1

ESTIMATED WORLDWIDE SEMICONDUCTOR CONSUMPTION
(1981-1988)



Source: DATAQUEST
May 1983

WORLDWIDE SEMICONDUCTOR CONSUMPTION

Worldwide semiconductor consumption grew only 3 percent during the 1981-1982 timeframe. The 1982 consumption figure grew to $14,616 million from the 1981 level of $14,259 million. Increases occurred in the three major categories of ICs, with the largest percentage change occurring in the MOS digital area, which grew by 13 percent. Consumption of bipolar circuits increased by 5 percent, and linear circuit consumption grew by 2 percent. Table 1 shows DATAQUEST estimates of 1981 and 1982 semiconductor consumption and their percentage growth.

Table 1

ESTIMATED WORLDWIDE SEMICONDUCTOR CONSUMPTION
1981 AND 1982
(Millions of Dollars)

	1981	1982	Percent Change
Total Semiconductor	$14,259	$14,616	3%
Integrated Circuits	$ 9,640	$10,421	8%
Bipolar Digital	$ 2,324	$ 2,438	5%
MOS	$ 4,671	$ 5,296	13%
Linear	$ 2,645	$ 2,687	2%
Discrete Devices	$ 3,832	$ 3,435	(12%)
Optoelectronic	$ 787	$ 760	(4%)

Source: DATAQUEST
May 1983

SEMICONDUCTOR CONSUMPTION BY GEOGRAPHICAL REGION

In 1982, the United States consumed an estimated $6,297 million in semiconductor devices, 43 percent of the worldwide total. Japan consumed approximately $4,037 million, or 28 percent, and Western Europe consumed an estimated $3,167 million, or 22 percent. Estimated consumption of the major categories of semiconductor devices is shown in Table 2.

Table 2

ESTIMATED 1982 SEMICONDUCTOR CONSUMPTION
BY GEOGRAPHICAL REGION
(Millions of Dollars)

	Total	United States	Japan	Western Europe	Rest of World
Total Semiconductor	$14,616	$6,297	$4,037	$3,167	$1,115
Integrated Circuits	$10,421	$5,050	$2,799	$1,988	$ 584
Discrete Devices	$ 3,435	$1,014	$ 988	$1,011	$ 422
Optoelectronic	$ 760	$ 233	$ 250	$ 168	$ 109

Source: DATAQUEST
May 1983

U.S. Semiconductor Consumption

U.S. semiconductor consumption increased 6 percent from an estimated $5,957 million in 1981 to $6,297 million in 1982. Integrated circuit consumption grew by 10 percent from $4,581 million in 1981 to $5,050 million in 1982, while U.S. consumption of discretes actually declined by $121 million, from $1,135 million in 1981 to $1,014 million in 1982.

Japanese Semiconductor Consumption

Japanese semiconductor consumption dropped 4 percent in 1982, from $4,207 million in 1981 to $4,037 million in 1982. This number is deceiving, however, since it is based on a shift in the currency exchange rate. When measured in yen, Japanese semiconductor consumption in the same time period increased 8 percent, IC consumption increased strongly, and discrete usage decreased 14 percent. In 1980-1981, strong consumer interest in VCRs and VTRs spurred production of the discrete devices used in these products. However, demand for these entertainment products slackened somewhat in 1982, causing an overabundance in the market. Since then, both consumption and production of discrete devices has declined.

West European Semiconductor Consumption

West European semiconductor consumption increased 4 percent in 1982, from $3,041 million in 1981 to $3,167 million in 1982. Increases occurred in all three categories, with consumption of ICs growing 5 percent, discrete devices 2 percent, and optoelectronic devices 9 percent.

Barbara A. Van

TABLE 13

HISTORICAL WORLDWIDE AVERAGE SELLING PRICES
(Dollars)
1974 through 1983

	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	CAG % (74–83)
Total Semiconductor	0.31	0.30	0.29	0.29	0.30	0.30	0.33	0.32	0.34	0.34	1.3
Total Integrated Circuit	1.04	1.01	1.01	1.02	1.01	0.97	1.07	1.03	1.01	1.05	0.0
Bipolar Digital (Technology)	0.65	0.60	0.61	0.66	0.63	0.57	0.70	0.70	0.62	0.65	0.0
TTL											
DTL											
ECL											
Other Bipolar Digital											
Bipolar Digital (Function)	0.65	0.60	0.61	0.66	0.63	0.57	0.70	0.70	0.62	0.65	0.0
Bipolar Digital Memory											
Bipolar Digital Logic											
MOS (Technology)	4.06	2.75	2.39	2.06	1.91	1.88	1.78	1.66	1.71	1.76	(8.9)
NMOS	4.80	4.43	4.71	4.46	4.46	3.66	3.08	3.06	2.91	3.15	(4.6)
PMOS	5.45	4.01	4.18	3.01	1.92	1.80	1.75	1.70	1.70	1.75	(11.9)
CMOS	1.50	0.78	0.73	0.68	0.55	0.61	0.70	0.74	0.77	0.81	(6.7)
MOS (Function)	4.06	2.75	2.39	2.06	1.91	1.88	1.78	1.66	1.71	1.76	(8.9)
MOS Memory						5.10	4.95	3.22	3.09	3.25	
MOS Microprocessor						3.96	3.61	3.40	3.34	3.36	
MOS Logic						0.89	0.85	0.86	0.80	0.79	
Linear	0.95	0.90	0.85	0.83	0.84	0.78	0.83	0.81	0.79	0.76	(2.4)
Total Discrete	0.18	0.16	0.15	0.14	0.13	0.12	0.12	0.11	0.11	0.09	(6.9)
Transistor	0.24	0.22	0.19	0.19	0.18	0.17	0.16	0.15	0.14	0.12	(7.4)
Small Signal Transistor	0.17	0.15	0.13	0.12	0.11	0.10	0.09	0.09	0.08	0.07	(9.4)
Power Transistor	0.74	0.68	0.73	0.78	0.73	0.70	0.68	0.56	0.54	0.49	(4.5)
Diode	0.10	0.10	0.09	0.08	0.08	0.07	0.07	0.07	0.07	0.06	(6.5)
Small Signal Diode	0.06	0.05	0.05	0.04	0.04	0.04	0.04	0.04	0.04	0.03	(7.4)
Power Diode	0.16	0.15	0.14	0.14	0.13	0.12	0.11	0.10	0.09	0.09	(6.2)
Zener Diode	0.20	0.17	0.15	0.15	0.18	0.11	0.14	0.14	0.13	0.12	(5.5)
Thyristor	0.86	0.83	0.89	0.92	0.91	0.89	0.98	1.09	0.95	0.92	0.8
Other Discrete	1.28	1.01	0.88	0.72	0.63	0.33	0.26	0.26	0.23	0.23	(17.4)
Total Optoelectronic	1.02	0.86	0.67	0.45	0.47	0.51	0.43	0.39	0.37	0.36	(10.9)
LED Lamps						0.18	0.13	0.12	0.12	0.12	
LED Displays						1.40	1.45	1.50	1.30	1.37	
Optical Couplers						0.79	0.83	0.77	0.70	0.66	
Other Optoelectronics						0.72	0.90	1.07	1.11	1.07	

Source: DATAQUEST

TABLE 15

HISTORICAL WORLDWIDE SEMICONDUCTOR CONSUMPTION
(Millions of Units)
1974 through 1983

	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	CAG % (74-83)
Total Semiconductor	17,718	14,741	20,287	24,241	29,419	36,463	42,059	44,765	43,951	54,533	13.3
Total Integrated Circuit	2,408	2,109	2,921	3,711	5,196	7,276	9,030	9,532	10,625	13,516	21.1
Bipolar Digital (Technology)	1,506	1,137	1,418	1,606	2,095	2,965	3,441	3,374	3,911	4,682	13.4
TTL											
DTL											
ECL											
Other Bipolar Digital											
Bipolar Digital (Function)	1,506	1,137	1,418	1,606	2,095	2,965	3,441	3,374	3,911	4,682	13.4
Bipolar Digital Memory											
Bipolar Digital Logic											
MOS (Technology)	217	304	518	783	1,255	1,840	2,745	2,853	3,245	4,366	39.6
NMOS	15	30	80	161	331	646	1,126	1,042	1,337	1,705	69.2
PMOS	128	152	157	204	299	309	270	228	194	184	4.1
CMOS	74	122	281	419	625	885	1,349	1,584	1,714	2,476	47.7
MOS (Function)	217	304	518	783	1,255	1,840	2,745	2,853	3,245	4,366	39.6
MOS Memory						328	457	634	866	1,129	
MOS Microprocessor						144	247	315	381	571	
MOS Logic						1,369	2,041	1,905	1,999	2,666	
Linear	685	668	985	1,322	1,845	2,471	2,843	3,305	3,468	4,468	23.2
Total Discrete	15,309	12,632	17,366	20,530	24,223	28,014	31,363	33,220	31,147	38,243	10.7
Transistor	5,852	4,878	6,840	7,466	8,619	9,826	11,245	12,960	12,285	15,186	11.2
Small Signal Transistor	5,141	4,253	6,100	6,658	7,673	8,700	9,967	11,389	10,813	13,400	11.2
Power Transistor	711	625	740	808	947	1,126	1,278	1,571	1,472	1,786	10.8
Diode	9,091	7,462	10,127	12,578	15,021	17,269	19,068	19,237	17,782	21,925	10.3
Small Signal Diode	5,383	4,220	5,720	7,725	9,050	10,500	11,250	10,800	9,575	12,900	10.2
Power Diode	3,013	2,653	3,600	3,993	5,054	5,442	6,618	7,230	6,922	7,667	10.9
Zener Diode	695	588	807	860	917	1,327	1,200	1,207	1,285	1,358	7.7
Thyristor	270	217	271	318	348	404	400	323	324	341	2.6
Other Discrete	97	75	128	168	235	515	650	700	757	791	26.3
Total Optoelectronic	191	262	430	680	889	1,173	1,666	2,012	2,179	2,774	34.6
LED Lamps						689	1,138	1,483	1,600	2,050	
LED Displays						182	201	195	227	261	
Optical Couplers						109	125	148	176	233	
Other Optoelectronics						193	201	186	177	230	

Source: DATAQUEST

10-25-84

WORLDWIDE SEMICONDUCTOR REVENUES
(Millions of Dollars)

COMPANY: ALL COMPANIES

	1976	1977	1978	1979	1980	1981	1982	1983
Total Semiconductor	5,827	6,924	8,877	11,065	14,022	14,380	14,950	18,945
Total Integrated Circuit	2,941	3,714	5,210	7,049	9,609	9,809	10,735	14,343
Bipolar Digital (Technology)	865	1,004	1,277	1,693	2,393	2,380	2,446	3,064
TTL	682	778	1,001	1,346	2,003	1,959	1,989	2,583
DTL	71	61	56	52	45	43	40	40
ECL	76	97	142	166	201	238	265	321
Other Bipolar Digital	36	68	78	129	144	140	152	110
Bipolar Digital SWAG	0	0	0	0	0	0	0	(0)
Bipolar Digital (Function)	865	1,004	1,277	1,693	2,393	2,380	2,446	3,064
Bipolar Digital Memory	0	3	4	326	578	553	510	613
Bipolar Digital Logic	33	81	75	1,367	1,815	1,827	1,936	2,451
Bipolar Digital SWAG	832	920	1,198	0	0	0	0	0
MOS (Technology)	1,239	1,613	2,398	3,429	4,885	4,752	5,549	7,802
NMOS	0	32	61	2,248	3,360	3,127	3,821	5,337
PMOS	0	22	44	512	515	448	373	359
CMOS	0	15	23	669	1,010	1,177	1,355	2,106
MOS SWAG	1,239	1,544	2,270	0	0	0	0	0
MOS (Function)	1,239	1,613	2,398	3,429	4,885	4,752	5,549	7,802
MOS Memory	0	6	10	1,660	2,254	2,041	2,664	3,663
MOS Microprocessor	0	3	6	565	880	1,067	1,263	1,908
MOS Logic	0	60	112	1,204	1,751	1,644	1,622	2,232
MOS SWAG	1,239	1,544	2,270	0	0	0	0	0
Linear	837	1,097	1,535	1,927	2,331	2,677	2,740	3,477
Total Discrete	2,598	2,897	3,230	3,407	3,673	3,763	3,372	3,540
Transistor	1,333	1,481	1,599	1,658	1,766	1,905	1,706	1,798
Small Signal Transistor	793	813	876	870	897	1,025	900	918
Power Transistor	540	668	723	788	869	880	806	880
Transistor SWAG	0	0	0	0	0	0	0	(0)
Diode	911	997	1,152	1,219	1,346	1,324	1,185	1,240
Small Signal Diode	286	309	362	420	450	432	383	387
Power Diode	504	559	643	653	728	723	635	690
Zener Diode	121	129	147	146	168	169	167	163
Diode SWAG	0	0	0	0	0	0	(0)	0
Thyristor	241	298	331	360	392	352	308	314
Other Discrete	113	121	148	170	169	182	174	188
Discrete SWAG	0	0	0	0	0	0	0	0
Total Optoelectronic	288	313	437	609	740	805	843	1,062
LED Lamps	54	77	107	131	148	182	192	255
LED Displays	151	144	193	255	291	292	295	357
Optical Couplers	29	35	53	84	104	122	133	171
Other Optoelectronics	54	57	84	139	197	212	223	279
Optoelectronic SWAG	0	0	0	0	0	0	0	0