Overview on

Taiwan Semiconductor Industry

(2008 Edition)

Taiwan Semiconductor Industry Association

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I. Preface

This ***Overview on Taiwan Semiconductor Industry*** is a translated excerpt from an ITIS (Industrial Technology Information Services) publication, which provides an overview of Taiwan semiconductor industry in 2007. Also included is a directory of Taiwan semiconductor companies. These data should be valuable to those who wish to establish business relationship in Taiwan.

ITIS is a market research project, which is supported primarily by the Taiwan government. For semiconductor portion of the project, research was conducted in Industrial Economics & Knowledge Center of Industrial Technology Research Institute (IEK/ITRI).

Since the establishment of the Electronics Research and Service Organization of the Industrial Technology Research Institute (ERSO/ITRI) in early 1970's and its successive spin-offs of UMC and TSMC in 1980's, the semiconductor industry in Taiwan has been growing at a very fast pace. Currently TSIA represents approximately 60% of worldwide IC foundry/package/testing revenue, around 25% of worldwide design revenue, and also around 25% of worldwide DRAM revenue. As the industry gains significant role in the global market place, information about Taiwan semiconductor industry is desirable worldwide. TSIA hopes this ***Overview on Taiwan Semiconductor Industry*** will serve as a useful reference for our global friends who seek to establish a closer connection with Taiwan semiconductor companies. We welcome your comments.

T.Y. Wu

President
Taiwan Semiconductor Industry Association

II. Taiwan Semiconductor Industry in Year 2007

Overview of the Year

Semiconductor market of Asia, the fastest-growing area, reached US$123.5 billion in 2007, a 6% increase from 2006. Taiwan semiconductor industry grew 5.3% in 2007, outpaced the worldwide average of 3.2% due to the dramatic growth of 23.6% in IC Design and 8.2% in Packaging. However, Taiwan IC manufacturing decreased by 3.9%, with a 3.2% increase in foundry and a 13.4% decrease in DRAM.

Taiwan IC revenue (including design, manufacturing, packaging, and testing) totaled NT$1,466.7 billion, a 5.3% growth from 2006, with NT$399.7 billion in design, a 23.6% increase, NT$736.7 billion in manufacturing, a 3.9% down, NT$228.0 billion in packaging, an 8.2% up, and NT$102.3 billion in testing, a 10.7% rise.

In 2007, Taiwan IC product revenue reached NT$684.2 billion (Table 1), a 5% increase from 2006. Memory products comprised 44.2%, down from the 52.7% of 2006 due to the DRAM price erosion. Logic IC comprised 45.1% (38.7% in 2006), Micro component IC 5.8%, and Analog IC 4.8%. Information applications, comprising 54.5% (59.7% in 2006), remained the largest application area. Consumer applications reached 30.6% (27.8% in 2006), and communication ICs accounted for 13.8% (11.4% in 2006).

Table 1 Major Indices for Taiwan IC Industry

(NT$B)

	2003	2004	2005	2006	2007	07/06 Growth
Industry Revenue	818.8	1,099.0	1,117.9	1,393.3	1466.7	5.3%
IC Design	190.2	260.8	285.0	323.4	399.7	23.6%
IC Manufacturing	470.1	623.9	587.4	766.7	736.7	-3.9%
Foundry	309.0	398.5	373.5	437.8	451.8	3.2%
IC Packaging	117.6	156.6	178.0	210.8	228.0	8.2%
IC Testing	40.9	57.7	67.5	92.4	102.3	10.7%
Product Revenue	351.3	486.2	498.9	652.3	684.6	5.0%
Domestic Sales (%)	47.9%	44.5%	43.2%	39.1%	37.8%	-
Domestic Market	402.1	558.9	580.3	611.4	574.7	-6.0%

Source：ITIS Project, IEK-ITRI (April 2008)

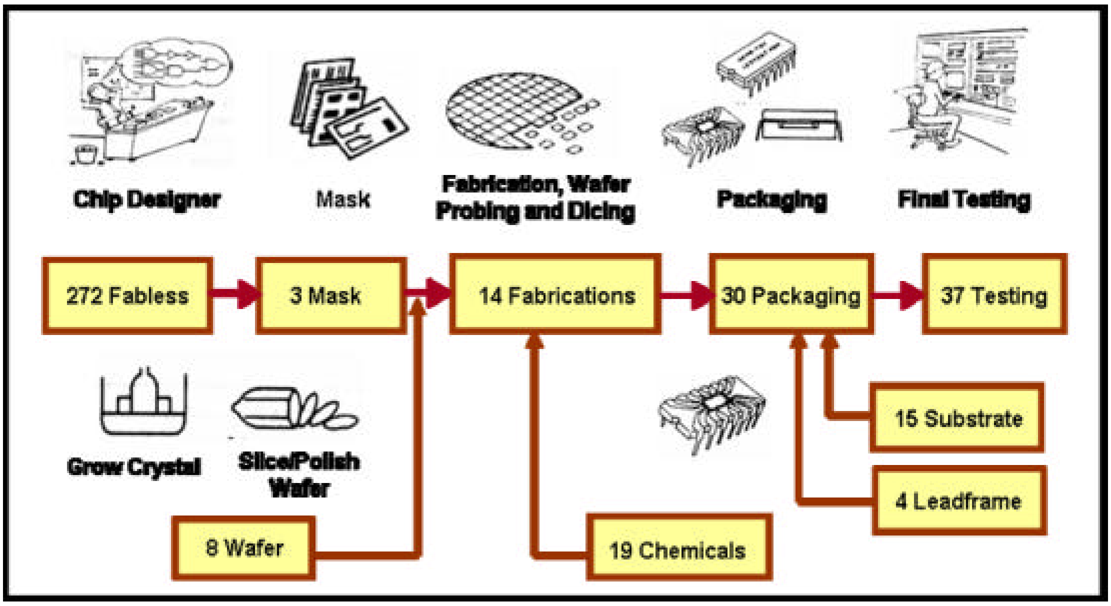


Fig. 1 Unique Disintegrated Infrastructure in Taiwan (2007)

By the end of 2007, Taiwan semiconductor industry consisted of 272 IC fabless design houses, 8 wafer suppliers, 3 mask makers, 14 fabrication companies, 30 packaging houses, 37 testing houses, 15 substrate suppliers, 19 chemical suppliers, and 4 leadframes companies, etc. (Figure 1). All the new developing countries in

Asia are trying to follow Taiwan's model to develop a vertically integrated infrastructure. This unique advantage of Taiwan semiconductor industry will clearly propel further advances.

IC Fabless Companies

Taiwan IC design revenue reached NT$399.7 billion, up 23.6% from 2006 and outpaced the growth of worldwide semiconductor sales due to new product applications (like Wii, PS3, iPhone) and a very high demand for multimedia cellular phone chips in new developing market. However, in 2008 the forecasted revenue has revised to NT$435.1 billion, only a mild 8.9% growth.

1. Major Indices

In 2007, there were 272 design houses with revenue NT$399.7 billion (Table 2), which was 27.3% of the total Taiwan IC revenue. (NT$1,466.7 billion per Table 1). The export ratio has been rising since 2002 (over 50%) and reached 67% in 2007. It was mainly due to the direct shipment requests from large Taiwanese system assembly lines in China. R&D expense reached NT$44.77 billion, which represented 11.2% of total fabless revenue, up from the 10.8% of 2006.

Table 2 Major Indices of Taiwan IC Fabless Business

	2003	2004	2005	2006	2007	2008(E)
Gross Margin	37.0%	34.6%	36.0%	37.0%	37.3%	36.9%
Operating Profit	21.4%	19.0%	20.1%	20.6%	20.8%	20.7%
Net Margin After Tax	20.4%	15.0%	16.3%	16.8%	17.1%	16.9%
Revenue Per Employee(NT$M)	15.14	12.42	11.24	12.73	11.32	11.16

Source：ITIS Project, IEK-ITRI (March 2008)

2. Application Sectors

ASSP (Application Specific Standard Product) remained the major application type (Table 3), comprising 89.5% of all applications and up from the 88.9% of 2006. ASIC (Application Specific Integrated Circuit) decreased from the 11.1% of 2006 to 10.5%.

Communication applications surged to 17.4% of all applications due to the steady growth shipment from Mediatek for new-generation handset products. Consumer applications decreased down to 39% due to the mature market. New products for integrated applications are essential in the future.

Among information application products, chip sets and storages IC are poor performers. In particular, gross profit of storage IC has been deteriorating. However, the strong demand of LCD monitor contributed to the increase in information application to 42.1% (comparing to 40% of 2006).

Table 3 Major Product Application of Taiwan IC Fabless Companies

	ASIC				ASSP				
	Information	Communication	Consumer	Others	Information	Communication	Consumer	Others	Total
2003	1.5%	1.5%	1.2%	0.0%	58.0%	9.2%	26.7%	1.4%	100%
2004	2.1%	0.1%	6.4%	0.0%	46.4%	9.7%	33.2%	2.1%	100%
2005	2.5%	1.0%	6.8%	0.0%	43.1%	11.6%	33.1%	1.9%	100%
2006	2.0%	1.3%	7.8%	0.0%	38.0%	15.4%	33.5%	2.0%	100%
2007	2.1%	1.4%	7.0%	0.0%	40.0%	16.0%	32.0%	1.5%	100%
2008(e)	2.1%	1.4%	6.5%	0.0%	41.0%	16.1%	31.4%	1.5%	100%

Source：ITIS Project, IEK-ITRI (March 2008)

3. Major Product Categories

The demands of TFT LCD monitor and color screen handsets have driven the growth of related products. 50.9% of the micro component revenue came from 8 bit MCU; while 22.0% from 16 bit MCU and 16.0% from 32 bit MCU, respectively, showing that local companies have been striving to develop high-end MCU products.

Niche memory revenue enjoyed a continued growth in 2007 due to the demand of related application such as STB, LCD, TV player, etc. However, memory revenue comprised only 10.7% of total design revenue, up from 10.6% in 2006. .

Thanks to the increased market shares of new products, and the addition of RFIC sales, analog ICs grew to comprise 8.2% in 2007 (8.1% in 2006).

Table 4 Major Product Types by Taiwan IC Fabless Companies

	Memory	Micro Component	Logic IC	Analog IC	Total
2003	14.5%	12.3%	68.3%	4.9%	100%
2004	16.0%	9.4%	69.6%	5.0%	100%
2005	10.8%	12.8%	68.5%	7.9%	100%
2006	10.6%	7.9%	73.4%	8.1%	100%
2007	10.7%	8.2%	72.9%	8.2%	100%
2008(e)	10.0%	8.8%	72.8%	8.4%	100%

Source：ITIS Project, IEK-ITRI (March 2008)

4. Market Distribution

The major driving force for Taiwan design revenue growth in 2007 remained the expansion of overseas markets, which comprised 67.1% (66.4% in 2006) of the design revenue (Table 5).

China has become the major global assembly base for electronic products due to its potential internal market and low production costs. It has been ranked number one in consumer products such as DVD player and home applications. Taiwan system companies such as PC, NB, and motherboard makers have set up production lines in China. Therefore, China/HK has become the largest market segment for Taiwan IC design companies, comprising 57.1%, up from 56.4% of 2006.

Table 5 Market Distribution for Taiwan IC Fabless Companies

	Taiwan	HK/China	North America	Japan	South Korea	S-E Asia	Others	Total
2003	45.4%	33.5%	3.0%	3.5%	10.5%	1.5%	2.6%	100%
2004	36.7%	50.9%	1.8%	3.7%	3.0%	1.6%	2.3%	100%
2005	34.0%	54.8%	1.3%	3.0%	2.4%	2.5%	2.0%	100%
2006	33.6%	56.4%	1.2%	2.7%	2.2%	2.4%	1.5%	100%
2007	32.9%	56.7%	1.4%	1.4%	2.8%	2.5%	2.1%	100%
2008(e)	32.7%	57.1%	1.3%	1.3%	2.7%	2.4%	2.2%	100%

Source：ITIS Project, IEK-ITRI (March 2008)

5. Top 10 Fabless Companies in Taiwan

Table 6 shows the top 10 Taiwan Fabless companies in 2007. Mediatek remained the number one, following by Novatek and Himax (LCD driver IC designers). The top eight companies were the same as those of previous year. Global Unichip, the tsmc invested company, achieved a 108% growth and become the leader in Taiwan IC design service due to its 65nm and 45nm advanced design. It reached a revenue of NT$6.99 billion in 2007 and ranked No. 9 for the first time.

Table 6 Top 10 Fabless Companies in Taiwan, 2007

(NT$B)

2007 Ranking	Company	2007 Revenue	2006 Revenue	Growth
1	Mediatek	80.41	53.01	51.7%
2	Novatek	36.13	31.43	15.0%
3	Himax	30.11	24.19	24.5%
4	Phison	20.26	12.45	62.7%
5	Realtek	15.71	12.42	26.4%
6	VIA	14.68	21.44	-31.5%
7	Etron	13.22	10.48	26.1%
8	Sunplus	9.21	17.08	-46.0%
9	Global Unichip	6.99	3.36	108.1%
10	ESMT	6.85	5.82	17.8%

*：Estimation note: exchange rate 2007 US$=NT$32.8, 2006 US$= NT$32.5
Source：ITIS Project, IEK-ITRI (January 2008)

IC Fabrication

As of 2007, there were 14 IC wafer fabrication companies in Taiwan, including foundry companies such as tsmc, UMC, Vanguard, Episil, Mosel-Vitelic, and AMPI; IDMs such as Winbond, MXIC and Lite-on ; and memory manufacturers such as Powerchip, Rexchip, Nanya, Promos, Inotera.

Following a fast growth of 30.5% in 2006, the IC manufacture industry exhibited a down trend in 2007. The increased 90nm and 65 nm productions of foundry companies helped the foundry revenue. But the oversupply of DRAM deteriorated DRAM revenue. 2007 Taiwan manufacturing revenue decreased 3.9% from 2006 and reached NT$736.7 billion (Table 7).

Capital investment, mainly in 12-inch fab capacity expansions, increased over 20%, reaching NT$365.7 billion, which represented 49.6% of total manufacturing revenue (higher than the 36.4% of 2006). R&D expense increased to 8.6% of total revenue. The indices of Taiwan IC manufacturing are not as optimistic as in 2006 due to most DRAM companies were not profitable in 2007.

Table 7 Major Indices of Taiwan IC Fabrication Business

Index/Year	2003	2004	2005	2006	2007	2008(e)
# of Companies	13	13	13	13	14	15
Revenue (NT$B)	470.1	623.9	587.4	766.7	736.7	752.8
Growth (%)	24.2%	32.7%	-5.9%	30.5%	-3.9%	2.2%
Line Width (μm)	0.09	0.09	0.065	0.065	0.045	0.045
Domestic: Export (%)	49%：51%	49%：51%	43%：57%	41%：59%	42%：58%	39%：61%
Capital Investment/ Revenue (%)	24.4%	41.2%	35.0%	36.4%	49.6%	35.1%
R&D/Revenue (%)	8.1%	5.4%	6.5%	7.6%	8.6%	8.3%

Source：ITIS Project, IEK-ITRI (April 2008)

Table 8 Major Efficiency Indices of Taiwan IC Fabrication Business

Index/Year	2003	2004	2005	2006	2007	2008(e)
Gross profit percentage	22.2%	36.2%	23.5%	28.6%	24.1%	12.6%
Profit percentage	9.4%	28%	16.2%	22.6%	13.9%	8.6%
Net profit percentage	9%	27.7%	15.8%	17.8%	13.4%	6.3%
Average revenue per person (in NT$ Million)	10.20	12.05	11.08	13.14	12.58	12.18

Source：ITIS Project, IEK-ITRI (April 2008)

1. Top 10 IC Fabrication Companies in Taiwan

tsmc and UMC remained the top two IC fabrication companies in 2007 (Table 9). tsmc's revenue reached a record high of NT$322.6 billion, a 1.6% increase from its 2006 revenue of NT$317.4 billion. UMC's revenue reached NT$106.8 billion, up 2.6% from 2006. Revenue of Vanguard, the 3rd largest foundry in Taiwan, grew 23.1% from 2006 to reach NT$16 billion. Episil revenue reached NT$5.0 billion, a 9.3% increase, and for the first time to be in the top 10 list. Mosel-Vitelic was out of the top 10 list due to its strategy shift.

Revenue of Winbond, one of the major IDM companies, decreased 6.9%, due to the down trend of DRAM market and the sales of its 8" fab to VIS. Thanks to the increased demand of ROM products such as consumer electronics games, MXIC revenue grew 6.6% in 2007.

The increasing capacity and yield of the 12-inch fabs, and the further shrink of process technology have raised the production of DRAM. Therefore, DRAM price crushed due to oversupply. Inotera showed the greatest growth of 12.5% due to its new 12-inch fab. Revenues of PSC, NTC, Promos, decreased 15.9%, 29.6%, and 20.7%, respectively.

Table 9 Top 10 Fabrication Companies in Taiwan, 2007

(NT$B)

2005 Ranking	2006 Ranking	Company	2006 Revenue	2007 Revenue	Growth
1	1	Tsmc	317.4	322.6	1.6%
2	2	UMC	104.1	106.8	2.6%
3	3	Powerchip	92.1	77.5	-15.9%
4	4	Nanya	75.1	52.9	-29.6%
5	5	Promos	60.1	47.6	-20.8%
7	6	Inotera	40.8	45.9	12.5%
6	7	Winbond	34.5	32.1	-6.9%
8	8	MXIC	22.8	24.3	6.6%
9	9	VIS	13.0	16.0	23.1%
11	10	Episil	4.6	5.0	9.3%

Source：IEK-ITRI (April, 2008)

2. Business Segments

Foundry revenue are better than DRAM in 2007 and accounted for 60.9% of total Taiwan IC manufacturing revenue, up from 57.1% of 2006. Although the oversupply of DRAM impact the total revenue of IC manufacturing, DRAM remained the major product sector of memory products, comprising 89.5% (91.2% in 2006).

China foundries have been striving for better competitiveness; however, growth has been slowed down in 2007, accounted for 14.1% of global foundry market (13.2% in 2006). SMIC of China become the 3rd largest foundry due to its strategic alliances with international IDMs. Overall, Taiwan foundry remained number one in the global foundry market. However, its market share declined slightly to 67.8% in 2007.

Table 10 Business Sectors of IC Fabrication in Taiwan

	Business Type (by revenue)						
	Standard Product, including ASSP				Customer Specific (ASIC)*	Foundry	Total
	Memory	Micro	Logic	Analog			
2001	24.3%	5.7%	1.1%	1.2%	0%	67.7%	100%
2002	27.3%	0.4%	6.6%	0.5%	0%	65.2%	100%
2003	28.7%	0.4%	5.2%	0%	0%	65.7%	100%
2004	34.2%	0.3%	1.7%	0%	0%	63.9%	100%
2005	33.6%	0.6%	2.2%	0%	0%	63.6%	100%
2006	40.4%	0.5%	2.0%	0%	0%	57.1%	100%
2007	36.0%	0.8%	2.3%	0%	0%	60.9%	100%

*: Full Custom and Semi-Custom IC designed for specific customers.
Source：ITIS Project, IEK-ITRI (April 2008)

3. Geographical Market

(1) Brand Products

Domestic market, comprising 44.6%, remained the largest market of Taiwan brand products. Japan, the second largest market, accounted for 16.9% due to the steady shipments of memory companies such as Powerchip. Sales to Europe increased from 6.5% of 2006 to 8.2% in 2007. Sales to China/HK decreased from 15.3% in

2006 to 14.1%. Sales to North America declined to comprise 10.3% (Table 11).

Table 11　Major Geographical Market for Taiwan Brand Products

	Taiwan	HK/China	S-E Asia	Japan	North America	Western Europe	Others	Total
2001	57.5%	8.1%	2.9%	14.9%	7.9%	7.8%	0.9%	100%
2002	47.3%	11.1%	5.5%	10.8%	10.9%	13%	0.3%	100%
2003	50.8%	13.9%	4%	10.3%	7.4%	11.1%	2.5%	100%
2004	51.2%	14.6%	1.5%	15.1%	7.6%	8.3%	1.7%	100%
2005	46.0%	13.7%	3.6%	16.5%	10.1%	7.9%	2.2%	100%
2006	45.3%	15.3%	3.6%	15.5%	12.0%	6.5%	0.8%	100%
2007	44.6%	14.1%	1.8%	16.9%	10.3%	8.2%	4.1%	100%

Source：ITIS Project, IEK-ITRI (April 2008)

（2）　Foundry

North America remained the largest export region for Taiwan foundry business, reaching 67% and a 0.7% drop from 2006 (Table 12). Taiwan, with the world second largest fabless business, was the second largest market, comprising 20.5%. The demand from Japan and China however will increase in the future due to the Fab-lite tendency of Japan IDM companies and China's growing market.

Table 12　Major Geographical Market of Taiwan IC Foundry

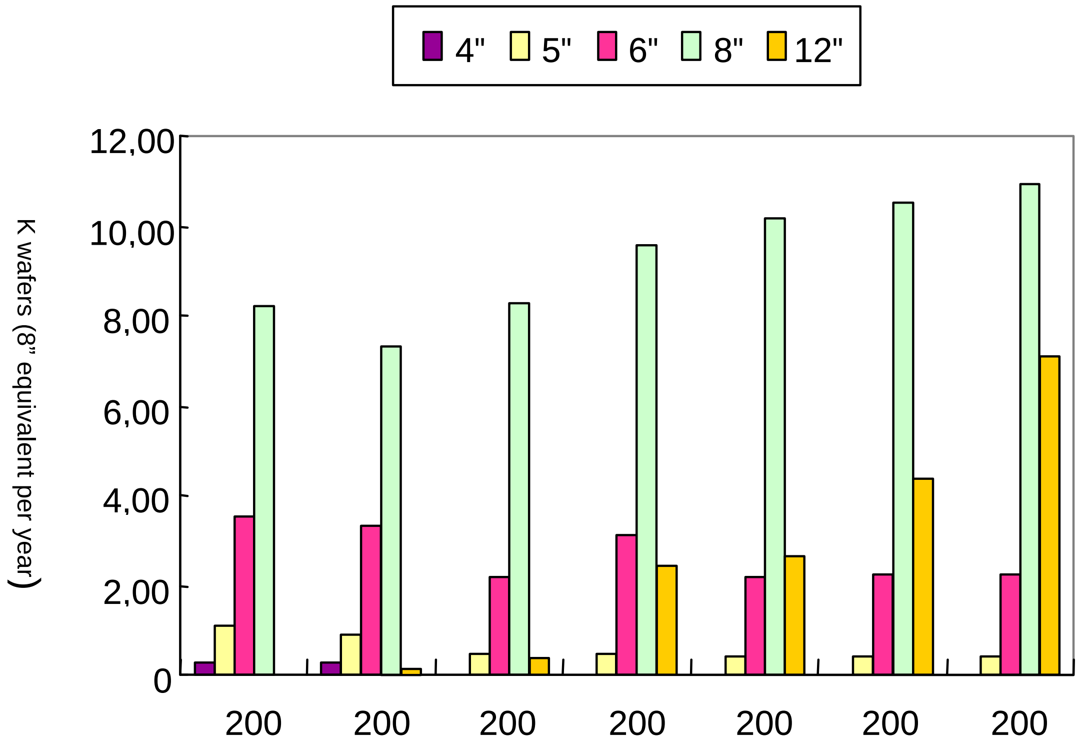
	Taiwan	North America	Western Europe	Others	Total
2000	24.3%	55.9%	12.2%	7.6%	100%
2001	23%	55.6%	10.8%	10.6%	100%
2002	22.5%	63.5%	7%	7%	100%
2003	22.9%	62.7%	8%	6.4%	100%
2004	18.6%	65.1%	10.2%	6.1%	100%
2005	21%	66.8%	6.9%	5.3%	100%
2006	21%	67.7%	6.1%	5.3%	100%
2007	20.5%	67.0%	6.0%	6.4%	100%

Source：ITIS Project, IEK-ITRI (April 2008)

4.　Capacity

Total Taiwan fabrication capacity (in 8” equivalent) grew 33.2% in 2007 (Figure 2), represents 20.1% of the worldwide capacity, up from the 19.2% of 2006. Capacity growth is mainly due to the expansion in 12 inch fabs of foundry companies (such as tsmc and UMC) and memory makers (such as Powerchip, Promos, and Inotera). Total capacity of Taiwan 12-inch fabs increased 60.8% in 2007.

As of 2007, fourteen 12-inch fabs are in mass production. Eleven of them focus on DRAM (Powerchip with 3, Promos with 3, Inotera with 2, Winbond with 1, NTC with 1,and Rexchip with 1), the other three focus on foundry (two belong to tsmc and one belongs to UMC). In 2008, there will be more capacity expansion in the 12-inch fab facility from DRAM industry by NTC, Promos, and Rexchip. It is expected that the 12” fabs will still be the focus of Taiwan IC companies’ expansion plans.



%growth (8”)	19.3%	-3.9%	15.8%	43.3%	15.6%	25.1%	33.2%
% of WW	14.7%	14.5%	16.1%	18.2%	18.4%	19.2%	20.1%

Source：ITIS Project, IEK-ITRI (April 2008)
Figure 2 Taiwan IC Fabrication Capacity

5. Process Technology

Taiwan CMOS process technology has advanced to 40 nm (Table 13). Taiwan foundry technology, mainly in logic products, is not only highly competitive in the global market but also surpasses the global leaders in technology. CMOS (RF) process technology has also migrated to 0.13 μm. Furthermore, to be ready for the SoC era, Taiwan companies should strive to develop versatile process technologies including BiCMOS, Mixed-Signal/RF, SOI, etc.

Table 13 Comparison on Mass-Production Process Technology

Technology	Taiwan	Benchmarked Regions	Technology by Benchmarked Regions
CMOS(Logic)	40nm	US, Japan	45nm
CMOS(RF)	0.13μm	Europe, US	0.13μm
BiCMOS	0.35μm	US, Japan, Europe	0.25μm
Bipolar	0.6μm	US, Japan, Europe	0.35μm
GaAs MESFET	0.5μm	US, Japan	0.5μm
GaAs HBT	1.0μm	US, Japan	1.0μm

Source：IEK-ITRI (April 2008)

IC Packaging

The sub prime mortgage crisis and the insufficient electricity supply due to big snow storm in China have impacted the revenue of Taiwan packaging companies. In 2007, it grew only 8.2% to NT$228.0 billion. After several merging, the Taiwan packaging/testing business decreased to 30 companies in 2007. (31 in 2006, Table 14).

Table 14 Major Indices of Taiwan Packaging Industry

	2003	2004	2005	2006	2007	2008(e)
# of Companies	38	37	33	31	30	30
Revenue (NT$B)	1,176	1,566	1,780	2,108	2,280	2,550
Growth (%)	24.1	33.2	13.7	18.4	8.2	11.8
Domestic: Export (%)	48:52	47:53	43:57	43:57	42:58	44:56
Capital Investment/Revenue (%)	13.8	18.9	10.5	11.2	11.8	12.0
R&D/Revenue (%)	2.7	1.7	1.2	1.3	1.4	1.4

Source：ITIS Project, IEK-ITRI (April 2008)

1. Top 5 Packaging Companies

Table 15 shows the top 5 Taiwan packaging companies in 2007. Total revenue (NT 164.1 billion) of top 5 companies comprised 72% of total Taiwan packaging revenue. Thus small companies are difficult to compete. ASE remained the top one but only 2.2% growth. (the revenue of ASE group includes revenues from its overseas subsidiaries). SPIL, with 14% strong growth, remained Top No. 2 in Taiwan. Powertech (rank No.3 on the table) has been successful in its new product strategy, covering Flash, MCP product and wBGA DDP DRAM.

Table 15 Top 5 IC Packaging Companies

(NT$B)

2006 Ranking	2007 Ranking	Company	2006 Revenue	2007 Revenue	Growth
1	1	ASE Group	76.82	78.51	2.2%
2	2	SPIL	49.52	56.47	14.0%
3	3	Powertech	9.10	13.94	53.1%
5	4	Chipmos	6.52	8.02	23.1%
4	5	Greateck	7.36	7.19	-2.3%

2. Product and Market Distribution

2007 packaging segment distribution remains the same. Flip Chip packaging enjoyed high growth rates due to chip sets and graphic IC requirements. It should reach more than 8% growth in 2008. The traditional type like QFP and TSOP, accounted for about 40% in packaging revenue.

Table 16 Product Distribution by Domestic Revenue

	DIP	SO*	QFP/ PLCC	BGA/ CSP	Bare Chip*	Others (including Bump)	合計
2003	2.8	18.2	26.3	39.0	8.7	5.0	100
2004	1.2	19.3	24.3	42.7	6.0	6.5	100
2005	0.7	20.3	16.8	48.0	7.9	6.3	100
2006	0.5	18.2	16.3	51.0	9.3	4.7	100
2007	0.4	17.5	16.5	52.5	9.5	3.6	100
2008(e)	0.3	17.0	16.6	53.0	9.7	3.4	100

1 SO*: including SOJ/SOP/TSOP
2 Bare Chip including TCP/COF/COG/Flip Chip/Sip/Stacked
Source：ITIS Project, IEK-ITRI (March 2008)

Table 17 Product Distribution by Domestic Volume

	DIP	SO*	QFP/ PLCC	BGA/ CSP	Bare Chip*	Others (Including Bump)	Total
2003	4.3	37.9	21.5	11.2	6.8	18.3	100
2004	3.4	35.4	18.1	16.1	7.7	19.3	100
2005	2.1	34.5	16.3	17.1	6.3	23.7	100
2006	1.4	30.1	16.4	17.5	8.5	26.1	100
2007	1.3	29.0	16.8	17.9	8.8	26.2	100
2008(e)	1.2	28.0	17.2	18.3	9.4	25.9	100

1.SO*: including SOJ/SOP/TSOP
2. Bare Chip including TCP/COF/COG/Flip Chip/Sip/Stacked
Source：ITIS Project, IEK-ITRI (April 2008)

Taiwan remained the largest market for its native packaging companies (Table 18 and 19). The increased outsourcing from IDMs in the US, Japan and Europe have resulted in packaging revenue growth from these regions.

Table 18　Geographical Distribution of Packaging Revenue (%)

	Taiwan	North America	Japan	Europe	HK/China/S-E Asia/Others	Total
2003	48.5	40.9	5.5	3.8	1.3	100
2004	42.1	41.9	7.4	4.5	4.1	100
2005	41.3	42.0	7.5	4.6	4.6	100
2006	42.4	41.3	7.2	3.9	5.2	100
2007	42.6	41.1	7.1	3.8	5.4	100
2008(e)	42.6	41.2	6.9	3.8	5.5	100

Source：ITIS Project, IEK-ITRI (April 2008)

Table 19　Geographical Distribution of Packaging Volume (%)

	Taiwan	North America	Japan	Europe	HK/China/S-E Asia/Others	Total
2003	53.5	31.6	7.8	4.8	2.3	100
2004	52.6	32.0	8.6	3.9	2.9	100
2005	50.0	32.5	8.9	4.0	4.6	100
2006	49.3	32.9	6.9	3.9	7.0	100
2007	49.6	33.0	6.8	3.8	6.8	100
2008(e)	49.4	32.9	7.0	3.7	7.0	100

Source：ITIS Project, IEK-ITRI (April 2008)

3. Packaging Industry Development

Taiwan IC packaging sector only reached 8.2% growth in 2007, the first time below 2-digit growth. The main causes are sub prime mortgage issues and economic slowdown. However, the 2008 Olympics will boost the demand for related products such as TV, handsets, etc. The conservative capacity expansion strategy will also lower the risk of oversupply.

Flip chip packaging and wafer level packaging are emerging technologies. The wafer level packaging technology is different from the traditional technology (to cut first and packaging later), and IC was cut after the wafer packaging and test. The "bump technology" will be the key. The increasing demands for wafer-bumping cause all major package companies (such as ASI, SPIL, Amkor…etc.) to expand bumping product line. Flip chip technology and WLP technology will be the major developing technologies in the future.

IC Testing

2007 Taiwan testing revenue growth has slowed down with single digit growth for most companies. This is mainly due to memory chip demand and price erosion. Total testing revenue reached NT$102.3 billion, a 10.7% growth from 2006.

Capital expenditure of Taiwan testing industry has dropped down to 30% of revenue. Most companies have a conservative outlook and would only invest capital to meet the short-term demand. In the example of Powertech, it will invest 60% of NT$8 billion to purchase the testing equipment to meet the demand of 1G DRAM and Flash, ThaiLin Semiconductor Corp. is investing on the logic test equipment due to Hynix and SanDisk shifing the memory testing order to Korea and China. Its Verigy 93000 equipment has increased from 21 to 30 sets to meet the logic testing demand. NTC hesitated to purchase any testing equipment due to the dropping demand of DRAM. KYEC has also a conservative outlook strategy and focused on logic IC and SoC testing equipment, with capital investment dropping to NT$5 billion in 2008.

Table 20 Major Indices of Taiwan IC Testing Business

	2003	2004	2005	2006	2007	2008(e)
# of Companies	39	39	35	37	37	37
Revenue (NT$B)	409	577	675	924	1,023	1,131
Growth (%)	29	41	17	36.9	10.7	10.6
Domestic: Export (%)	57:43	55:45	59:41	58:42	57:43	57:43
Capital Investment/ Revenue (%)	33.8	50.3	35.6	38.0	36.0	36.0
R&D/Revenue (%)	2.5	1.8	2.0	2.2	2.3	2.3

Source：ITIS Project, IEK-ITRI (April 2008)

1. **Top 5 Testing Companies**

ASE, although slowed down, remained number one in Taiwan testing industry, KYEC, ranked No.2 in Taiwan, and reached 80% in capacity utilization. KYEC revenue reached NT$1.26 billion in August.

Chipmos and Spil grew steadily with 2 digit growth, Chipmos showed over 10% growth due to successful switching from DDR2 to flash business. PTI reached 33.3% growth. Although memory chip price continually drop, PTI still maintained 30% gross margin.

Table 21 Top 5 IC Testing Companies

(NT$B)

2005 Ranking	2006 Ranking	Company	2006 Revenue	2007 Revenue	Growth
1	1	ASE Group*	21.43	20.01	-6.6%
2	2	KYEC	10.75	12.41	15.5%
3	3	Chipmos	9.37	11.56	23.4%
4	4	PTI	8.04	10.72	33.3%
5	5	SPIL	5.01	5.68	13.3%

*: Including ASE Test and ASE Inc
Source：IEK-ITRI (March 2008)

2. Product and Market Distribution

Memory remained the major product in 2007, and accounted for 60.1% of total testing revenue (Table 22). DRAM revenue is mainly from DDR2 and gradually shifts to DDR3 in 2008. Flash testing has been growing fast due to the demand for multi-functional handsets, MP3 player, digital camera, portable USB drives.

Domestic market was the major market for the Taiwan testing business, comprising 57.5%. North America, comprising 28.7%, was the second largest market. The major Taiwan testing companies has a long term contract with multi-national companies. It will thus assure the testing revenue from international sector. The order from China is also increasing due to the large demand from memory foundry. (Table 23)

Table 22 Product by Domestic Revenue

	Memory	Logic & Micro-component	Mixed Signal	Linear	RF	Others	Total
2003	52.6	23.4	21.0	1.4	1.0	0.6	100
2004	54.5	20.3	22.3	0.9	1.2	0.8	100
2005	59.0	21.0	17.4	0.4	1.1	1.2	100
2006	59.9	21.3	16.4	0.2	1.1	1.0	100
2007	60.1	21.2	16.5	0.2	1.3	0.7	100
2008(e)	60.0	21.3	16.5	0.2	1.3	0.7	100

Source：IEK-ITRI (April 2008)

Table 23 Market Distribution for Taiwan IC Testing Industry

	Taiwan	North America	Japan	Europe	HK/China/S-E Asia/Others	Total
2003	57.4	30.9	7.6	2.1	2.0	100
2004	55.6	31.6	8.4	2.2	2.2	100
2005	58.5	29.0	5.6	1.1	5.8	100
2006	57.9	28.8	5.7	1.1	6.4	100
2007	57.5	28.7	5.6	1.2	7.0	100
2008(e)	57.4	28.8	5.6	1.1	7.1	100

Source：IEK-ITRI (March 2008)

III. Taiwan IC Market

In 2007, Taiwan IC market reached NT$ 574.7 billion, a 6% decrease from the NT$611.4 billion of 2006. Imported ICs decreased 11.4% to NT$316.1 billion and exported ICs increased 7.3% to NT$538.7 billion. Major driving forces were the increased shipments of down-stream PCs, DRAM modules, internet and communication products, LCD monitors, etc.

South Korea, comprising 39.6%, remained the largest importing region (mainly memory products including Flash and DRAM) for local demand (Table 24), followed by China, Thailand, Japan, and Malaysia. With multinationals such as Intel and Samsung setting up packaging lines and Taiwan companies such as ASE and OSE setting up branches for serving local customers and shipping products back to Taiwan, these countries have been the major import countries for Taiwan IC market these years.

In export, most IC product exported in half-finished goods or transferring goods. It tends to overstate the export value due to the custom report showing finished goods value. As in Table 25, the export value will be higher than the actual IC export value.

Table 24 Top 10 Import Regions of Taiwan IC Market

(NT$B)

Ranking	2006			2007		
	Country	Amount	Market Share	Country	Amount	Market Share
1	South Korea	136.4	38.2%	South Korea	125.2	39.6%
2	China	37.5	10.5%	China	29.3	9.3%
3	Japan	33	9.3%	Thailand	27.5	8.7%
4	Philippines	28.8	8.1%	Japan	25.6	8.1%
5	Malaysia	26.9	7.5%	Malaysia	20.5	6.5%
6	Thailand	19.9	5.6%	Philippines	19.4	6.1%
7	US	14.8	4.1%	US	11.0	3.5%
8	Singapore	14	3.9%	Singapore	10.4	3.3%
9	Germany	4.2	1.2%	Germany	2.5	0.8%
10	HK(China)	2.1	0.6%	Costa Rica	1.9	0.6%
	Others	38.9	11.0%	Others	42.7	13.5%
	Total	356.7	100.0%	Total	316.1	100.0%

Source：Taiwan Customs, ITIS Project, IEK-ITRI (April 2008)

Table 25 Top 10 Export Regions of Taiwan IC Market

(NT$B)

Ranking	2006			2007		
	Country	Amount	Market Share	Country	Amount	Market Share
1	HK(China)	127.6	25.4%	HK(China)	151.3	28.17%
2	China	105.4	21.0%	Japan	100.3	18.6%
3	Japan	99.9	19.9%	China	84.1	15.6%
4	Singapore	58.0	11.5%	Singapore	67.6	12.5%
5	Thailand	26.6	5.3%	Thailand	32.9	6.1%
6	US	22.3	4.4%	US	26.5	4.9%
7	Malaysia	18.3	3.6%	Malaysia	22.7	4.2%
8	South Korea	13.3	2.7%	South Korea	15.9	3.0%
9	Philippines	6.6	1.3%	Netherlands	11.2	2.1%
10	Netherlands	5.8	1.2%	Philippines	7.1	1.3%
	Others	18.3	3.7%	Others	19.1	3.6%
	Total	502.12	100.0%	Total	538.7	100.0%

Source：Taiwan Customs, IEK-ITRI (April 2008)

IV. Outlook

The Industrial Economics & Knowledge Center (IEK) of the Industrial Technology Research Institute (ITRI) predicts that the 2008 Taiwan IC revenue (including design, manufacturing, packaging and testing) will reach NT$1,556.0 billion, a 6.1% growth from 2007, with NT$435.1 billion from design sector, an 8.9% growth; NT$752.8 billion in manufacturing, a 2.2% up ; NT$255 billion in packaging, a 11.8% rise; and NT$113.1 billion in testing, a 10.6% growth.

V. Directory of Taiwan Semiconductor Companies

Fabless

5V Technologies Ltd.
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AAT
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www.aatech.com.tw

ACARD
TEL:886-2-85122290
FAX:886-2-85122548
www.acard.com

AccFast
TEL:886-3-6662756
FAX:886-3-6662758
www.accfast.com.tw

Acute
TEL:886-3-5790680
FAX:886-3-5775606
www.acutecomm.com.tw

AFA
TEL: 886-2-29189958
FAX:886-2- 29189975
www.afatech.com

AIC
TEL: 886-3-5772500
FAX:886-3- 5772510
www.analog.com.tw

AIT
TEL:886-3-6560528
FAX:886-3-6565051
www.a-i-t.com.tw

Airoha
TEL: 886-3-6128800
FAX:886-3- 6116680
www.airoha.com.tw

Alchip Technologies
TEL: 886-2-27992318
FAX:886-2-66065876
www.alchip.com

Alcor Micro Corp.
TEL:886-2-87511984
FAX:886-2-26597723
www.alcormicro.com

AlfaPlus
TEL:886-3-5163270
FAX:886-3-5163267
www.alfaplus.com.tw

ALI
TEL:886-2-87522000
FAX:886-2-87511003
www.ali.com.tw

Alpha
TEL:886-3-5736660
FAX:886-3-5736661
www.ealpha.com.tw

Altus
TEL:886-3-7587888
www.altus-tech.com

Ambarella
TEL:886-3-6668828
FAX:886-3-6661282
www.ambarella.com

AME
TEL:886-2-26278687
FAX:886-2-26592989
www.ame.com.tw

AMIC
TEL:886-3-5679966
FAX:886-3-5679965
www.amictechnology.com

AMIC Communication
TEL:886-3-5785818
FAX:886-3-5785819
www.amiccom.com.tw

Ampson
TEL:886-3-5725527
FAX:886-3-5725529
www.ampson.com.tw

Amtek
TEL:886-2-29998989
FAX:886-2-29992929
www.amtek-semi.com

ANA
TEL:886-2-26558628
FAX:886-2-26558676
www.anatek.com.tw

AnaGlobe
TEL:886-3-6668001
FAX:886-3-6661976
www.anaglobe.com.tw

ANDES
TEL:886-3-6668300
FAX:886-3-6668322
www.andestech.com

AnMO
TEL:886-3-5357868
FAX:886-3-5358098
www.anmo.com.tw

ANPEC
TEL:886-3-5642000
FAX:886-3-5642050
www.anpec.com.tw

APEC
TEL:886-3-5750576
FAX:886-3-5737701
www.a-power.com.tw

APLUS
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FAX:886-2-27829255
www.aplusinc.com.tw

Arques Technology
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FAX:886-2-89131366
www.arquestech.com

ASIX
TEL:886-3-5799500
FAX:886-3-5799558
www.asix.com.tw

Asmedia
TEL:886-2-28936345
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www.asmedia.com.tw

ASPEED
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FAX:886-3-5789586
www.aspeedtech.com

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ASUKA
TEL:886-3-6667117
FAX:886-3-6667104
www.asuka-semi.com.tw

Atech
TEL:886-2-82215488
FAX:886-2-82215489
www.8tec.com

Attansic
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FAX:886-3-5169335
www.attansic.com

AuMOS
TEL:886-3-5790567
FAX:886-3-5775909
www.aumos.com.tw

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FAX:886-2-87523989
www.averlogic.com

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FAX:886-3-5771011
www.avid.com.tw

Avisonic Technology
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FAX:886-3-6661301
www.avisonic.com

Aviq
TEL:886-3-5633766
FAX:886-3-5633761
www.aviqtech.com

Beyond Innovation
TEL:886-2-27785939
FAX:886-2-27781050
www.bitek.com.tw

BSI
TEL:886-3-5770398
FAX:886-3-5787439
www.bsi.com.tw

Capella
TEL:886-2-82186600
FAX:886-2-82186602
www.capellamicro.com

CFP
TEL:886-3-5770755
FAX:886-3-5770756
www.cfpt.com.tw

Champion
TEL:886-3-5679979
FAX:886-3-5679909
www.championmicro.com.tw

CHESEN
TEL:886-2-82265589
FAX:886-2-82265181
www.chesen.com.tw

Chip Design
TEL:886-2-22994908
FAX:886-2-22990133
www.cdt.com.tw

Chip Hope
TEL:886-2-82271166
FAX:886-2-82271296
www.chiphope.com.tw

CHiPLUS
TEL:886-3-5637887
FAX:886-3-5637877
www.chiplus.com

Cion
TEL:886-3-6003888
FAX:886-3-6002888
www.cion.com.tw

CMSC
TEL:886-3-5634866
FAX:886-3-5634863
www.cmsc.com.tw

C-Media
TEL:886-2-87731100
FAX:886-2-87732211
www.cmedia.com.tw

CoAsia
TEL:886-2-26557699
FAX:886-2-26557189
www.coasia.com.tw

Conwise
TEL:886-3-5779880
FAX:886-3-5779870
www.conwise.com.tw

CTC
TEL:886-3-5311161
FAX:886-3-5338403
www.ctcasic.com.tw

CYRUSTEK
TEL:886-3-5910216
FAX:886-3-5910217
www.cyrustek.com.tw

D&W Technologies
TEL:886-2-27857796
FAX:886-2-27859416
www.dwtech.com.tw

DATARiT
TEL:886-3-5169089
FAX:886-3-5169087
www.ritdata.com

Davicom
TEL:886-3-5798797
FAX:886-3-5646929
www.davicom.com.tw

DenMOS
TEL:886-3-6669777
FAX:886-3-5667766
www.denmos.com.tw

DESTINY
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FAX:886-2-26552345
www.destiny.com.tw

Digiwell
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FAX:886-3-5639464
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FAX:886-3-5783630
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FAX:886-2-27978808	FAX:886-2-26592987	FAX:886-3-5781623
www.eeti.com	www.eftech.com.tw	www.emc.com.tw
ELANsat	**ElecVision**	**eMemory**
TEL:886-3-5635105	TEL:886-3-5798602	TEL:886-3-5631616
FAX:886-3-5635107	FAX:886-3-5643528	FAX:886-3-5632525
www.elansat.com.tw	www.elecvision.com	www.ememory.com.tw
ENABLE	**ENE**	**Enova**
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FAX:886-3-5525236	FAX:886-3-6662999	FAX:886-3-5772770
www.enable-semi.com	www.ene.com.tw	www.enovatech.net
EON	**EOREX**	**Epicom**
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FAX:886-3-5525696	FAX:886-3-5585139	FAX:886-3-5775180
www.eonssi.com.tw	www.eorex.com	www.epic.com.tw
ESMT	**Etoms**	**Etrend**
TEL:886-3-5781970	TEL:886-3-6661766	TEL:886-6-5050170
FAX:886-3-5781971	FAX:886-3-6661765	FAX:886-6-5050175
www.esmt.com.tw	www.etomscorp.com	www.etrend.com.tw
Etron	**Eureka**	**Evercorp**
TEL:886-3-5782345	TEL:886-3-5799255	TEL:886-2-87971106
FAX:886-3-5784949	FAX:886-3-5779253	FAX:886-2-87971107
www.etron.com.tw	www.eureka.com.tw	
EverMore	**EXPLORE**	**Faraday**
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FAX:886-3-5798303	FAX:886-3-5643596	FAX:886-3-5787889
www.emt.com.tw	www.epmi.com.tw	www.faraday-tech.com/index.html

Feature Integration Technology
TEL:886-3-5600168
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www.fintek.com.tw

Feeling Technology
TEL:886-3-5600588
FAX:886-3-6205511
http://www.feeling-tech.com.tw/km-master/front/bin/home.phtml

FocalTech Systems
TEL:886-2-27850809
FAX:886-2-27854727

Fortune
TEL:886-2-28094742
FAX:886-2-28094874
www.ic-fortune.com

FRONTAND
TEL:886-3-5326601
FAX:886-3-5326692
www.frontand.com.tw

F3 Inc.
TEL:886-3-5775535
FAX:886-3-5775532
www.f3.com.tw

Gemstone
TEL:886-2-23886868
FAX:886-2-23882699
www.gemstone.com.tw

Generalplus
TEL:886-3-6662118
FAX:886-3-6662117
www.generalplus.com

Genesys Logic, Inc.
TEL:886-2-89131888
FAX:886-2-89131688
www.genesyslogic.com.tw

G-Link
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FAX:886-3-5786641
www.glink.com.tw

Global Unichip Corp.
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FAX:886-3-6669809
www.globalunichip.com

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TEL:886-3-5788833
FAX:886-3-5784289
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Goldkey
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Goyatek
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Grenery
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www.gstc.com.tw

G-Time
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FAX:886-3-5733638
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Henwood
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Higher Way
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FAX:886-4-23550022
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HiMARK
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Himax
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www.himax.com.tw

Holtek
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FAX:886-3-5631189
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Holylite
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FAX:886-3-5734690
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ICARTiS
TEL:886-2-26547688
FAX:886-2-26549188
www.icartisusa.com

ICNexus
TEL:886-2-27891200
FAX:886-2-27891201
www.icnexus.com.tw

ICPlus
TEL:886-3-5750275
FAX:886-3-5750475
www.icplus.com.tw

ICSI
TEL:886-3-5780333
FAX:886-3-5783000
www.icsi.com.tw

IDESYN
TEL:886-3-6586257
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ILITEK
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www.ilitek.com

Imagiatek
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FAX:886-2-26968411
www.imagiatek.com

Incentia
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FAX:886-3-5785028
www.incentia.com

InCOMM
TEL:886-2-26599609
FAX:886-2-26599603
www.incomm.com

InfoMax
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www.infomax.com.tw

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TEL:886-2-87516377
FAX:886-2-87510165
www.initio.com

Inmax
TEL:886-2-89131300
FAX:886-2-89131301
www.inmax.com.tw

Innochip
TEL:886-3-6663077
FAX:886-3-6661339
www.innochip.com.tw

INNO-TECH
TEL:886-2-87913636
FAX:886-2-87913699
www.inno.com.tw

IPLIB
TEL:886-3-5169288
FAX:886-3-5169283
www.iplib.com

ISSC
TEL:886-3-5778385
FAX:886-3-5778501
www.issc.com.tw

IST
TEL:886-2-87977911
FAX:886-2-87977915
www.ist4u.com

ITE Tech. Inc.
TEL:886-3-5798658
FAX:886-3-5794535
www.ite.com.tw

Jeilin
TEL:886-2-82215466
FAX:886-2-82215456
www.jeilin.com.tw

Jmicron Technology
TEL:886-3-5797389
FAX:886-3-5799566
www.jmicron.com

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True Test
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FAX:886-3-5973737
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FAX:886-3-5770068
www.vate.com.tw

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FAX:886-3-5772379
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FKS
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PSi
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www.psi.com.tw

San Chih Semi
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FAX:886-3-4833347
www.tatung.com/scsc/

Shin-Etsu
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FAX:886-3-5771199
www.shinetsu.co.jp

Sino-American
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FAX:886-3-5781706
www.saswafer.com

Waferworks
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Rectron Ltd.
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TSC
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