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## **The Status of the Semiconductor Industry in Taiwan**

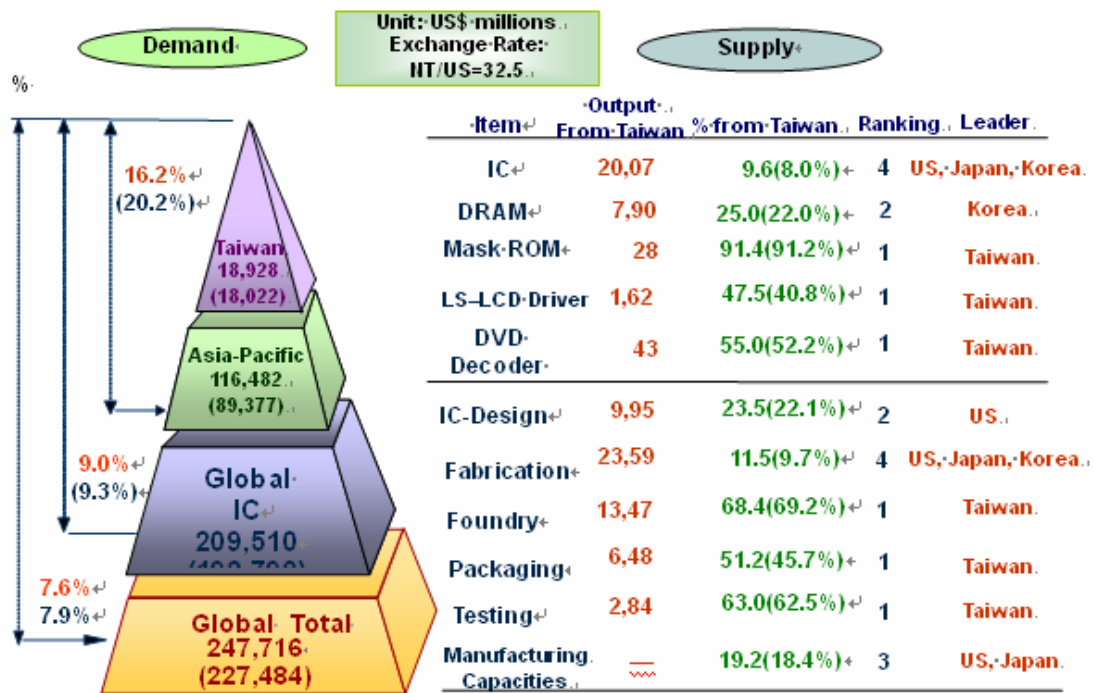
### **(I) Supply & Demand**

Launched in 2002 the “Two Trillion and Twin Star” project chose the semiconductor and display industries as its key component industries with output values expected to break NTD 1 trillion, and the digital content and biotech industries as its emerging industries with core advantage. This project mainly focuses on the establishment of related assistance and guidance policies. The government set up Semiconductor Industry Promotion Office to increase the output value of Taiwan’s semiconductor industry, to develop Taiwan as the center of IC design, IC development, and IC manufacturing, and to increase added-value for Taiwan’s semiconductor industry.

Taiwanese enterprises are delivering a great performance in the global semiconductor industry. TSMC and UMC are ranked 1<sup>st</sup> and 2<sup>nd</sup>, respectively in the global IC manufacturing industry; Media Tek ranks 7<sup>th</sup> in the IC design industry; ASE and SPIL rank 1<sup>st</sup> and 3<sup>rd</sup>, respectively in the IC packaging & testing industry.

Research from the Topology Research Institute show, that the output value of the IC manufacturing sector will reach US\$27.76 billion in 2008, growing by 22% over the same period in 2007. In addition, output values for the IC design and packaging & testing sectors will be around US\$13.3 billion and US\$11.89 billion, and show a 12% and 20% year-on-year growth, respectively. The nation’s IC industries will meet positive growth exceeding global performance totally. On the demand side, IC market value US\$18.9 billion in 2006, taking up 16.2% of global market share.

## Taiwan's IC Industry Value Chain Structure



Source: Industry & Technology Intelligence Service, MOE, 2007/04

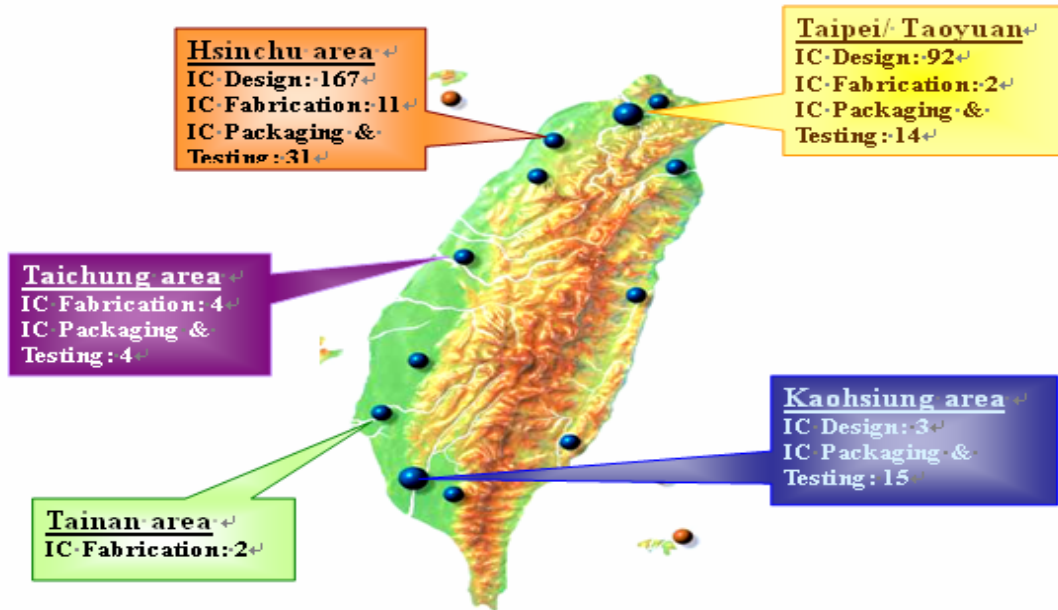
### (II) Analysis of a Gap in the Industry Supply Chain, Investment Niches, and Prospective Foreign Investors

After long development, Taiwan's semiconductor industry has distinguished itself from its complete industry clusters to incorporate from IC Design, Manufacturing to Packaging & Testing companies. The globe-leading IC Foundries and IC Packaging & Testing companies together offer the best deal of one-stop shopping model. There are 262 IC Design companies, 13 IC fabrication plants, 34 IC Packaging companies, 36 IC Testing companies in Taiwan, showing the advantages of vertical specialization of Taiwan's semiconductor industry.

Taiwan's semiconductor industry companies mainly are distributed in Hsinchu and the Great Taipei. Hsinchu is the home of two thirds of companies including MediaTek, Novatek, Sunplus, Realtek, SiS, Richtek,

Anpec and etc. The rest companies are located in Taipei area such as VIA, Ali, ULi, Prolific etc. Most of IC fabrications are spreading in Taoyuan, Hsinchu, Taichung and Tainan; furthermore, the first-tier packaging & testing companies are aggregated in the central and southern parts of Taiwan .

**Taiwan, transforming into a “Silicon Island”**



**Complete up-streams to down-stream clusters of Taiwan’s semiconductor Industry**

**Most IC Design companies are located in the Hsinchu and Taipei areas.**  
Hsinchu area (About 2/3 of companies): Mediatek, Novatek, Sunplus, Realtek, SiS, Richtek and Anpec etc.  
Taipei area (About 1/3 of companies): VIA, Ali, ULi, Prolific etc.

**Foundry and Fabrication are located in Taoyuan, Hsinchu, Taichung and Tainan**  
Taoyuan: Nanya, Inotera Memories  
Hsinchu (Hsinchu Science Park): TSMC, UMC, PSC, ProMos, Winbond, Micronix, VIA, Mosel  
Taichung (Taichung Science Park): PSC, Rexchip, ProMos, Winbond  
Tainan (Tainan Science Park): TSMC, UMC

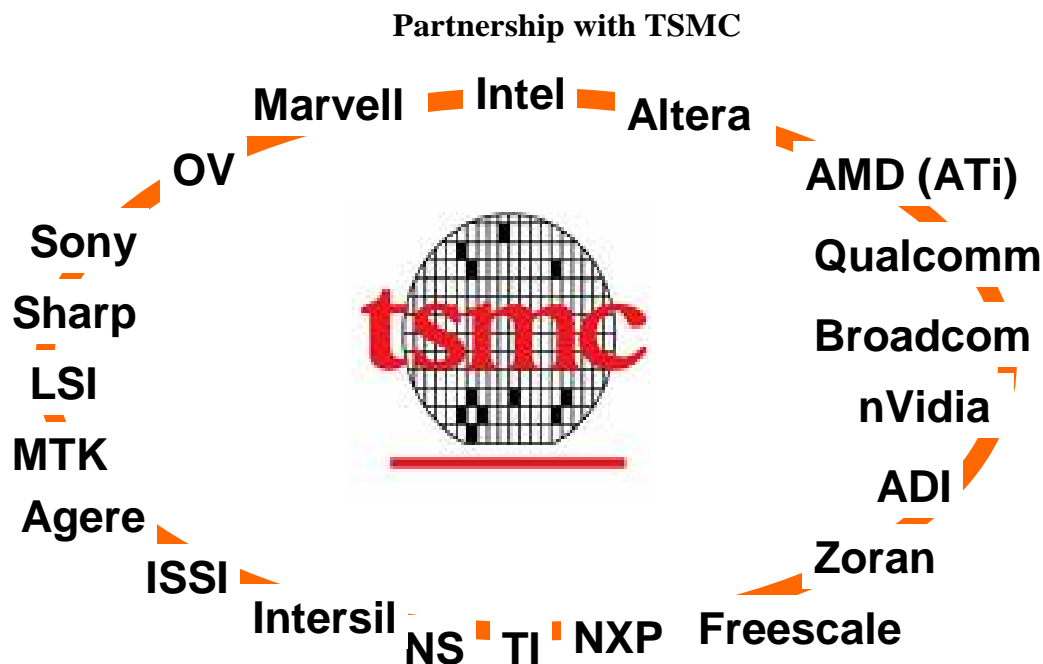
**First-tier Packaging & Testing companies are concentrated in the central and southern parts of Taiwan.**  
Taichung: SPIL  
Kaohsiung: ASE, OSE

Source: Industrial Development Bureau, Minister of Economic Affairs (MOEA), organized for

the present Study, 2007/12

To analyze the potential business of semiconductor industry, with a complete industry chain and strong techniques, Taiwan has many powerful global clients and extensive networkings with international companies. In the upstream of IC manufacturing, among the leading five DRAM companies around the globe, Samsung has set up the procurement hub and sales point in Taiwan. Furthermore, there are some companies delegating authorities to each other, such as Hynix and ProMOS, Elpidia and PSC, Qimonda and Nanya Technology, Inotera Technology and Winbond. In April 2008, Nanya Technology had cooperations with Micron and co-signed to establish the joint venture. In view of this, it is recommended that Taiwan semiconductor industry should work on the supply chain's gap through global cooperations, in order to prevent the situation of DRAM's price falling.

As for the semiconductor dedicated foundry industry in the mid-stream, we can take TSMC, the global leading company, for example. There are over 50% of 20 global leading semiconductor companies which are TSMC's clients, including Intel, the leading foreign business. Furthermore, 8 out of global 10 leading IC Design companies place orders to TSMC, showing TSMC has great significance in the global semiconductor industry. Even the other two potential foreign business with IC Design, Xilinx and Sandisk, also place their orders to IC manufacturers from Taiwan. These facts show Taiwan semiconductor industry has a widespread range of clients.



Source: Individual company and organized for the present study, 2007/12

Taiwan semiconductor industry is short of the related facilities and components of semiconductor industry, which makes Taiwan semiconductor industry face a sharp pressure from cost competitiveness of equipment and facilities. If the foreign investment could bridge the gap, the supply chain could be more complete to make more profits and benefits. Besides, the key component facilities such as photo resist spinner, lithography facility, rely on imports. Though there are some foreign businesses involving in the upstream, they merely serve for the purpose of technical services. The recommended way to cooperate is to invest in R&D on key components and to introduce key techniques such as gas control system, wafer transfer mechanism, processing reaction, and vacuum system technique.

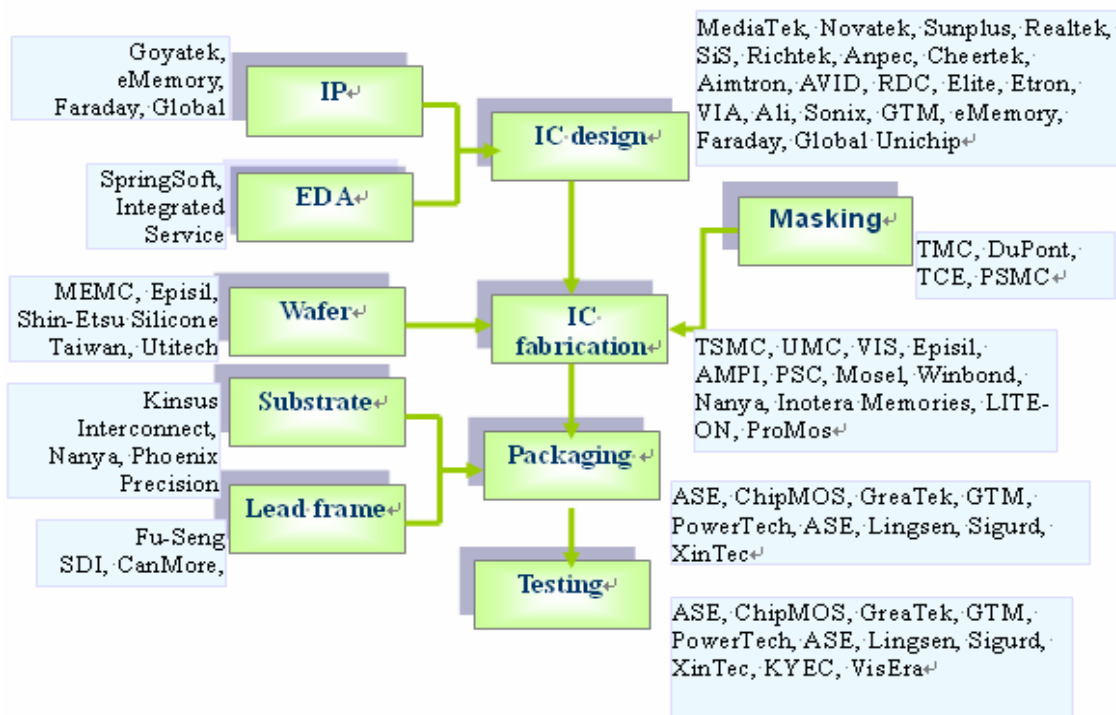
As for the gap of the supply chain, the recommended foreign businesses are facility manufacturers, like Applied Materials, Tokyo Electron, ASML, KLA-Tencor, Lam Research, Advantest, Nikon, Novellus Systems, Canon; IC design companies, like Qualcomm, Broadcom, Nvidia, SanDisk, ATI, Xilinx, Marvell, Altera, Conexant, QLogic, CSR, Silicon Lab, SST, Solomon

System; IC manufacturers, like Intel, Samsung, TI, Toshiba, STM, Renesas, Hynix, NXP, Freescale, NEC, Micron, AMD, Infineon, Qimonda, Elpida; IC packaging and testing companies, like Amkor, STATS-ChipPAC, UTAC, Carsem, Shinko, ASAT.

### (III) Major Suppliers in Taiwan

The output value of Taiwan's semiconductor industry had achieved the goal of NTD 1 trillion in 2005, and the output value is estimated to hit NTD 2 trillion by 2010. Under the cooperation between government and industry, Taiwan reinforces the networking within the industry through integrating the related resources of RoC to form a SoC industry cluster, making Taiwan the global R&D center. The vision is to make Taiwan becoming the center of global SoC design and manufacturing in order to build up SoC autonomy techniques.

#### . Taiwan's Semiconductor Industry Supply-Demand Chain Structure



Source: organized for the present study, 2007/12

Taiwan is the second largest IC design center, only behind the United States. Most noted firms include MediaTek, Novatek Microelectronics, PixArt Technologies, Elan Microelectronics and Phison Electronics. MediaTek, an IC design company ranked seventh place in the world, has been a leading provider of total solutions for consumer electronics and communication products. This company is the global top supplier of DVD IC, holding 40% shares of mobile phone IC market in China. The most recent development for MediaTek is aiming at the emerging market of digital TV IC application. Phison Electronics has maintained the top three positions in USB and NAND flash applications by providing advanced technology. PixArt Technologies, possessing strategic relationship with Nintendo Co., Ltd., provides image sensor and object tracking technology for Nintendo's new-generation game, the Wii. The PixArt's IC controller could enable Nintendo to present innovative interaction game Wii which has been the hottest product in the global market in recent years.

Taiwan's IC fabrication continues to grow rapidly with its outstanding performance in profitability and production capability. The silicon foundry service pioneer model Taiwan Semiconductor Manufacturing Co. (TSMC) provides fifty percent of global market demand with the 65 nanometer (nm) process, and advances to the cutting-edge 45 nm and 32 nm process technology. Other than TSMC, United Microelectronics Corporation (UMC) is the second major foundry player in the market, and Powerchip Semiconductor Corp (PSC), ProMOS Technologies Corp. and Nanya Technology Corp. are engaged in DRAM manufacturing production. In recent years, Taiwan semiconductor industry wants to get rid of OEM mode because it is more difficult to build up international brands with low-end products. Some successful companies like HMI and AIBT which cut in the fields of defeat measurement and ion implantation, launches new brands. The products are not only sold to TSMC, UMS, ProMOS, but also to the North

America and Singapore; however, the amount and quantity are still far below the global level.

In line with its very strong IC foundry industry, Taiwan has also developed into a leading position in the world's IC packaging & assembly arena. ASE (Advanced Semiconductor Engineering Inc.) Group, the world's largest provider of semiconductor packaging & assembly services, develops and offers a wide portfolio of technology and solutions including BGA, Flip Chip to wafer level package. In addition, Siliconware Precision Industries Co, (SPIL) also holds the third position worldwide in semiconductor packaging and assembly business. The main clients include ATI, Qualcomm International, FreeScale. In IC Design, Media Tek did a great job in China; furthermore, Media Tek is expected to replace Trident to be a leading IC manufacturer in North America. The clients include Samsung, LG, and Philips.

In conjunction with design and fabrication segments, up-stream silicon-proven IPs service and EDA tool technology are also emerging into Taiwan's semiconductor supply chain. Global Unichip Corp.(GUC), which has close investment partnership with TSMC, Faraday Technology Corp., a member of UMC Group, SpringSoft Corp. and Integrated Service Technology Inc. are companies in lieu of advanced technology development. Regarding masking and IC substrate business, Taiwan Mask Corp., Nanya Technology Corp. and Phoenix Precision Technology Corp. are carrying out business with outstanding performances.