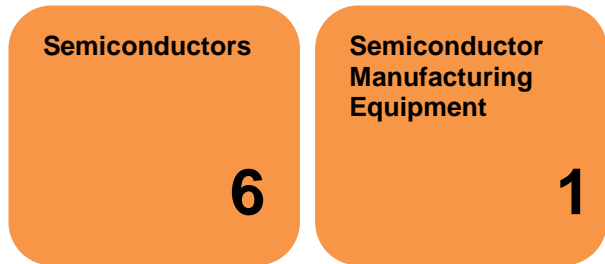




2016 Top Markets Report **Semiconductors and Semiconductor Manufacturing Equipment** Country Case Study

Taiwan

Taiwan is the top market for semiconductor manufacturing equipment and the sixth largest U.S. export market for semiconductors. Taiwanese companies are major manufacturers of electronics equipment. Final product assembly often takes place in China, and semiconductor export sales are mainly attributed to that market. Both design and buying decisions for the semiconductors in the electronic equipment, however, often take place in Taiwan. Taiwan, a participant in the WTO Information Technology Agreement (ITA) and the WTO ITA expansion (with implementation beginning July 1, 2016), presents no significant tariff or non-tariff barriers to U.S. exports. Taiwan’s leadership in semiconductor foundry necessitates purchase of state-of-the-art semiconductor manufacturing equipment.



Overview of the Markets

Taiwan is home to electronic equipment manufacturers like Acer, ASUSTek (computers and computer parts) and HTC (smart phones). Taiwan is also home to the largest EMS (electronic manufacturing services – contract manufacturing of ICT equipment) company in the world, Foxconn/Hon Hai. Although much of the manufacturing takes place outside of Taiwan (especially in China), electronic equipment manufacturers and EMS companies often share the semiconductor and other component buying decisions.

Taiwan’s semiconductor production industry had sales of approximately \$71 billion in 2015, of which \$31.6 billion were from Taiwan’s leading semiconductor foundry subsector. Major Taiwanese semiconductor companies are Taiwan

Semiconductor Manufacturing Company (TSMC) and United Microelectronics Company (UMC), both of which serve as foundries (contract semiconductor manufacturing companies) for fabless IC design companies in the United States and elsewhere. DRAM production was \$6.9 billion; fabless production was \$18.6 billion, and the balance (\$13.9 billion) was in OSAT (Outsourced Semiconductor Assembly and Test).¹ With the cost of building a new semiconductor fab (manufacturing facility) in the billions of dollars, many semiconductor companies worldwide contract their manufacturing to Taiwan – the largest semiconductor foundry manufacturing economy in the world. TSMC and UMC are major customers for U.S. semiconductor manufacturing equipment.

Most Taiwan semiconductor production takes place in science parks, which offer favorable conditions for

many types of high-tech manufacturing. Leading science parks include Taiwan Hsinchu Science Park (HSP) (which also includes electronic equipment manufacturing), Southern Taiwan Science Park (STSP) and Central Taiwan Science Park (CTSP) (which also includes computer manufacturing), with total sales of \$44 billion in semiconductor related business for 2015.²

Semiconductors

The size of the Taiwan market for semiconductors is not available, and import and export statistics for Taiwan are skewed by the large OSAT industry in country. The closest estimate we can come up with based on Taiwan's production of electronic products containing semiconductors and the size of Asia other than Japan, China and other semiconductor market is 3 percent of the world market.³ This estimate does not include production outside of Taiwan by subsidiaries of Taiwanese electronic equipment and EMS (electronic equipment manufacturing on contract) companies, so it underestimates the importance of this market.

Computer and telecommunications equipment companies are the largest buyer sectors of semiconductors in Taiwan,⁴ including major producers Acer, ASUSTek and HTC.⁵ As mentioned above, while assembly of Taiwanese brand electronic products often takes place in China, the semiconductor buying decisions are made in Taiwan. For instance, for servers, electronic equipment manufacturers often make the buying decision for microprocessors and power ICs, and EMS companies often make the buying decision for sensors and other support role semiconductors.⁶ Foxconn/Hon Hai has manufacturing facilities around the world, most notably in China, where it employs over 1 million workers.

Semiconductor Manufacturing Equipment

Taiwan has consistently been the top global market for semiconductor manufacturing equipment in recent years, representing over a quarter of the total worldwide market. The Taiwanese market was valued at \$9.6 billion in 2015.⁷ The U.S. is the top importer of semiconductor manufacturing equipment into Taiwan, representing \$3.9 billion, or 32 percent of Taiwanese imports. United States imports into Taiwan rose 16 percent from 2014 to

2015 while Taiwan's imports from the world fell 6 percent over the same period.⁸ Taiwanese foundries TSMC and its rival UMC are both global leaders in semiconductor manufacturing and buy state-of-the-art semiconductor manufacturing equipment. TSMC is ranked second globally in estimated capital spending, with \$9.5 billion forecast for 2016.⁹ UMC is ranked eighth, with forecasted capital expenditure of \$2.2 billion for 2016.^{10 11} There are also a number of smaller semiconductor manufacturers in Taiwan, primarily in the memory segment, that also purchase semiconductor manufacturing equipment.

Suppliers of U.S. semiconductor assembly and test equipment (as distinct from wafer fab equipment) will also find Taiwan an excellent market. Although China has more total factory floor space dedicated to contract semiconductor packaging/final assembly and test, Taiwan also hosts a considerable amount of OSAT capacity (nearly 20 percent of worldwide OSAT factory floor space). Also, Taiwanese companies own much of the OSAT capacity in China and are the leaders in this segment. Taiwanese OSAT companies, in many cases, make the buying decisions for semiconductor assembly and test equipment used by subsidiaries of their companies in China.¹²

Challenges and Barriers to U.S. Semiconductor and Related Equipment Exports

There are no significant barriers to U.S. semiconductor or semiconductor manufacturing equipment exports to Taiwan. As a participant in the WTO Information Technology Agreement and the recent WTO ITA expansion, Taiwan allows imports of most semiconductors and related manufacturing equipment to enter duty-free. Taiwan's semiconductor industry is world-class, but it is dominated by foundry manufacturing, which generally partners, rather than competes, with U.S. semiconductor manufacturers (except in the case of other foundries, such as Globalfoundries). Taiwan is the only other market besides the U.S. with a substantial fabless industry (18 percent share of the market). Many U.S. fabless semiconductor companies directly benefit from contracting production of their integrated circuit designs to Taiwan. Taiwan also is a competitor in the fabless space. Taiwan does have a small DRAM manufacturing industry, but it has never reached a notable share of that market. Taiwan's production of semiconductor manufacturing equipment is very

limited and poses little competitive challenge to U.S. suppliers.

Opportunities for U.S. Companies

Taiwan is open to trade in both semiconductors and semiconductor manufacturing equipment and presents a good market for U.S. companies.

WTO Information Technology Agreement Expansion

Implementation of the expansion will begin in July 2016. Taiwan will offer immediate duty-free access for almost all of the semiconductor and semiconductor manufacturing related products covered by the WTO ITA expansion. Semiconductor-related products that are not granted immediate zero are photoresist; fans for microprocessors; CMP (chemical-mechanical planarization) pads; FOSB (front opening shipping boxes) and similar special containers for conveying and shipping semiconductor wafers, masks and reticles; specialty pumps, heat exchange units, and liquid and gas filtering equipment for semiconductor fabs; and electron microscopes. These will all be duty-free when exported to Taiwan in 2019 after three tariff cuts.¹³ See Appendix 1 for a list of the semiconductor-related products in the WTO ITA expansion, information on the WTO ITA expansion and links to key documents.

Semiconductors

WSTS (World Semiconductor Trade Statistics) forecasts that the Asia-Pacific/Other market for semiconductors, which includes Taiwan, will grow 0.2 percent in 2016 and another 3.1 percent in 2017.¹⁴

There are a variety of export opportunities for U.S. companies, which include semiconductors used in

display products, like computer touch-screen panels, smartphone screens and LCD monitors, and semiconductors used in data center equipment (computer servers and data storage and switching equipment) to facilitate the growth in cloud computing. Semiconductors (especially sensors and communications ICs) used in the Internet of Things (IoT) will be a major demand driver over the next 10 years, though it is starting from a low base value.

Semiconductor Manufacturing Equipment

Although fab equipment spending was essentially flat last year, SEMI forecasted in March 2016 that the market would grow 3.7 percent in 2016, followed by 13 percent growth in 2017.¹⁵ Taiwan is expected to be a large contributor to the growth in 2017, with five semiconductor fabs starting construction in 2015 to 2016, which will lead to equipping in 2017 and later,¹⁶ and is forecast to remain the top market for semiconductor manufacturing equipment.¹⁷ Taiwan overtook South Korea in 2015 to become the world leader in IC fab capacity,¹⁸ so there will be increased sales (replacement and upgrades) in the future. U.S. semiconductor manufacturing equipment suppliers already enjoy considerable success in Taiwan, and this trend should continue in the near-term. Just in the first quarter of 2016, TSMC announced it had purchased equipment from U.S. semiconductor manufacturing equipment companies Applied Materials and Lam Research for a total of about \$8.6 billion,¹⁹ and ASE (Taiwan), the top-ranked OSAT company in the world, announced three purchases of semiconductor assembly and test equipment for a total of about \$52.6 million from Kulicke and Soffa (U.S.), Besi (Netherlands) and Disco (Japan).²⁰

2016 Trade Shows/Events in Taiwan

September 7-9: SEMICON Taiwan. Taipei, Taiwan.

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- ¹“TSIA Q4 2015 and Year 2015 Statistics on Taiwan IC Industry”, [TSIA Report](#) 2/19/2016.
- ²“Taiwan science parks post 2015 total revenues of over NT\$2.3 trillion, says MOST”, [Digitimes](#) 2/25/2016.
- ³WSTS data and Reed Electronics Research data.
- ⁴[Yearbook of World Electronics Data 2014 Volume 2 – America, Japan and Asia Pacific](#) Reed Electronics Research
- ⁵[A Decade of Unprecedented Growth: China’s Impact on the Semiconductor Industry 2014 Update](#) Price Waterhouse Coopers
- ⁶“Taiwan Players Have Strong Influence in Server Upstream Supply Chain” [Digitimes Research](#), 3/28/2015.
- ⁷[Worldwide Semiconductor Equipment Market Statistics by Category and by Region](#) SEMI, 3/2015.
- ⁸Global Trade Atlas
- ⁹“UMC Raise 2016 Capex to 2.2 Billion on Improving Outlook”, [EETimes](#),1/27/2016.
- ¹⁰Ibid.
- ¹¹“2015 Semiconductor Capex led by Memory and Foundry”, [Design and Reuse](#) 4/23/2015.
- ¹²“IC Manufacturing Equipment Market History and Forecast”, 10/2014. [VLSI Research](#).
- ¹³[WTO members conclude landmark \\$1.3 trillion IT trade deal](#) – Includes link to the parties’ national line schedules. [WTO](#), 12/16/2015. Also see Appendix 1.
- ¹⁴“Worldwide Semiconductor Market is expected to be slightly positive in 2016 and grow moderately in 2017”, [World Semiconductor Trade Statistics Press Release](#), 2/25/2016.
- ¹⁵“Double Digit Growth in 2017?”, [SEMI.org](#), 3/14/2016.
- ¹⁶[World Fab Watch](#), SEMI, 3/4/2016
- ¹⁷[SEMI’s 2015 Year –End Semiconductor Equipment Forecast Report](#), SEMI, December 2015
- ¹⁸“Taiwan Passes South Korea to Become #1 in Total IC Wafer Fab Capacity”, [IC Insights Research Bulletin](#), 2/29/ 2016.
- ¹⁹“TSMC Buys Equipment from Applied, Lam”, [Digitimes](#) 3/23/2016.
- ²⁰“ASE Orders Equipment Worth NT\$1.72 Billion”, [Digitimes](#), 3/16/2016.