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Chip Scale REVIEW

EXTRA!

January 1, 2005


# Automatic Test Equipment and China: Looking to the Future

**By Paul M. Sakamoto, Contributing Editor**

***Pleasanton, Calif.*—The ongoing growth and transformation of the semiconductor business in China is viewed with great awe.**

Sakamoto

The component market was $15 billion (USD) in 2002 and is growing at a 30 percent compound annual growth rate (CAGR). It is likely that 2004 will account for over $30 billion of semiconductor production in China.

## THE MARKET

**China's growth has major implications in the amount of ATE (automatic test equipment) sold for use in this vital marketplace. In established semiconductor production markets, sales of ATE range from 2-2.5 percent of the component shipment dollars.**

In a highly growing market that does not have a very large installed infrastructure, such as China, the figure can range as high as 4-6 percent of shipments.

*Test lines, like this one at STATS ChipPAC's Singapore facility, are migrating into China.*

The exact amounts are impossible to predict because of product mix. For example, large SOC (system-on-a-chip) testing costs can run somewhat higher than these numbers due to their high cost per test socket. Memory and linear components tend to take a lower percentage rate due to the extremely high volumes and efficiency of their test process.

**In 2004, these numbers resulted in an estimated overall range of ATE revenue between $60-180 million in China.**

My prediction is that the ATE market will continue to follow IC revenue growth in China, but it will tend to be at the lower

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# ATE in China (Continued)

end of these nominal percentages**.** There are reasons for this that we will look at in more detail below.

**HIGH-VOLUME, LOW-MARGIN APPLICATIONS**

**Initial IC production in China has been dedicated to consumer product applications such as DVDs, PC I/O, RFID, consumer ASICs, toys, and home entertainment.**

Moderate performance networking and wireless applications have also occupied a lot of growth. The requirements for these commodity devices are high quality and very low cost.

These demands ares being met using a mix of new and surplus equipment that is not adequate for leading edge applications in 90nm; although the gear is fine for producing 180nm and above technology. This has provided a low entry cost for Chinese producers, and it provides great yields when producing >0.25µm devices.

*Part of the test area at Carsem's high-volume facility in Suzhou, China*

**The performance of a 0.25µm technology is much greater than necessary for many of these applications, and a 200mm wafer still offers great economy of scale for these medium integration components.**

The effect this has on test is that the bulk of the test equipment for the consumer sector does not have to be the highest performance, high-cost equipment that has been the standard in Europe, Japan, the U.S. and Taiwan.

To serve the largest part of the China ATE market, several vendors have made major commitments. For example, Teradyne has a manufacturing facility in China that allows them to simultaneously lower taxes while serving their customers more rapidly.

**SUBCONTRACTORS**

Another key mainstream application in China is represented by the subcontract test houses built to take advantage of the low cost of highly educated labor. For instance, flash memory test and DRAM test are very high volume applications that have benefited from the move to China.

**These applications are very test-capital efficient, however, with an equipment cost per test socket range of**

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**$5k-$40k/socket. That cost is likely to be in line with older SOC test flows that are employing a mix of low-end and used equipment.**

This, however, is in sharp contrast to a new, big, mixed signal SOC, which might have a >$1 million cost per test socket. Since the mix of product in the near-to-medium term will still be biased in the direction of low-cost test equipment, the ATE revenue will continue to be relatively low compared to the IC shipments.

**PRICE PRESSURE**

**Another downward pressure on ATE pricing in China is coming from the significant number of systems that have been produced locally for digital and linear applications..**

There are two reasons these systems came into being: The first is historical. Until fairly recently, there were many restrictions regarding the shipment of semiconductor technology to China.

One of the restricted items was ATE, with the primary restriction the maximum allowed cycle rate of the digital test portion. In the mid-1990s, for example, this maximum cycle rate was 40MHz.

**In the 1980's, most ATE shipments from the U.S. were totally banned. In reaction, the local industry devised its own ATE equipment. In many cases, the functionality, software and specifications were relatively low-end, but so was the cost. This last point brings us to the other driving force for locally produced ATE:the cost.**

Today, the biggest driver for locally designed and produced ATE in China is that it is a lot less expensive than alternatives from outside vendors.

**When compared to traditional vendors, the Chinese sources are likely to be in the $100-$200/digital pin range. They do not provide very good device debug or analysis capability, nor are they likely to be marketed outside their regional area. However, a lot of the volume in China is shipped from these machines and from purpose-built systems based on PC motherboards and other inexpensive platforms.**

The tendency has been for design teams to share a higher-end tester, either in their company, or at one of the large "incubator" facilities that house hundreds of start-up, fabless companies.

This higher performance, easier-to-use ATE is employed to debug, characterize and bring up the devices. The bulk of production is then moved to a very low-cost platform if possible. And it is nearly always possible to do this.

**I believe that low-cost electronics will continue to be a staple of the Chinese market and that low-cost semiconductors will continue to play a huge role. To maintain this very low cost, the locally produced systems will continue to flourish and spoil the high-volume, low-end, market for the larger ATE companies.**

Although the past and the present of ATE in China has been dominated by low to middle performance systems, there is a clear initiative to move into the higher-end arena.

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## ATE in China (Continued)

Since the initial applications will tend to have a military usage, this is one area that will see a lot less price sensitivity.

However, the farther-reaching consequences will still point to a lower cost solution. The driving force for this will be the microprocessors that will be placed in the one billion PCs needed in China.

***Mr. Sakamoto is president of Inovys Corp., and a veteran of the ATE industry. Prior to Inovys, he was vice president and general manager of the Memory Products Division of Credence Systems Corp. [paul.sakamoto@inovys.com]***

## Silicon Turnkey Will Consolidate Its IC Assembly Operations

**By Ron Iscoff, Editor**

**Manteca, Calif.—Silicon Turnkey Solutions, a niche IC assembler and test provider operating chiefly from the historic site once owned by Jake Ratinoff's Indy Electronics, has put the facility up for sale.**

STS will consolidate its packaging operations in the Bay Area at a site not yet selection.

*Operations for the Manteca facility (shown) will be consolidated in the Bay Area, some 65 miles west. (Chip Scale Review)*

Sultan Lilani, the company's business development manager, told *Chip Scale Review* that the company will exit high-volume plastic IC assembly, including QFPs, and will concentrate on packaging flip chips, MEMS and hi-end military devices. Lilani said STS owns the two-story, 90,000 square-foot Manteca facility, which is located on a 12-acre site about 65 miles east of downtown San Jose. In the 1980s, Indy was Manteca's largest employer with a headcount of nearly 1,400.

*Malik*

In the years since Indy sold the facility, its owners have included ASE, Alphatec Group, Olin, Digital Testing Service and ISE Labs. **(CONTINUED)**

## Silicon Turnkey Will Consolidate (Continued)

**Since Zef Malik, his brother Saeed Malik, and two others bought the facility in 1999, the number of employees has never exceeded 150, sources estimate.**

In an interview with Malik in 2001 (***Chip Scale Review***, July 2001, "Assembly Lines"), the STS president said the Manteca operation employed 105.

**The company also owns a Fremont, Calif., operation, which is known as Test and Reliability. It provides contract testing and reliability qualification services.**

**STS, according to Lilani, sees a bright future packaging MEMS and concentrating on military and ruggedized IC packaging.**

The Manteca equipment that will be employed for flip chips, MEMS and military parts will be moved to the Bay Area. Equipment that is specific to plastic packaging will be sold, Lilani reported. [siliconturnkey.com]

## Amtech Introduces Lead-Free Version of SynTECH-LF Solder

**Branford, Conn.—AMTECH Inc. has introduced a lead-free version of its SynTECH-LF synthetic solder paste, said to be the first and only no-clean solder-paste formula produced from 100 percent synthetic poly adduct components.**

*SynTECH-LF is offerred in cartridges, cassettes, jars and syringes.*

The formula is designed specifically for use with SMT assemblies, and is compatible with tin/silver and tin/silver/copper alloys.

AMTECH claims that the compound needs no refrigeration, exceeds IPC SIR testing requirements, provides a wide process window (12-hour stencil life and 12-16 hour tack time) and offers increased throughput with less scrap and rework. The company offers SynTECH-LF in cartridges, cassettes, jars and syringes. [amtechinc.com]

## Palomar Technologies Will Supply Fabrinet with Gear

**Vista, Calif.—Palomar Technologies has signed an agreement to supply EMS provider Fabrinet, Bangkok, Thailand [fabrinet.com] with optoelectronics- and other packaging equipment.**

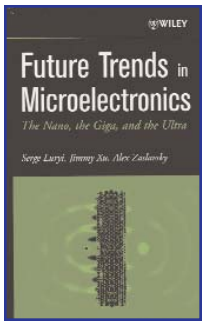
The equipment will include Palomar's Laser Diode Attach component assembly cell and a Model 8000 high-speed thermosonic ball and stitch wire bonder. [bonders.com]

## IC Assembler Corwil Expands; Moves to New Location

**Milpitas, Calif.—Corwil Technology Corp. has moved to larger quarters at 1635 McCarthy Blvd., Milpitas, CA 95035. The company's phone and fax numbers, 408/321-6404 and 408/321-6407 respectively, remain the same. [corwil.com]**

## ENGINEERS' BOOKSHELF

***Future Trends in Microelectronics***
**Reviewed by Terrence Thompson, Senior Editor [tethompson@aol.com]**




**Title:** *Future Trends in Microelectronics: The Nano, the Giga and the Ultra*
**Editors:** Serge Luryi, Jimmy Xu and Alex Zaslavsky
**Publisher:** Wiley-IEEE Press [wiley.com]
**ISBN:** 0-471-48405-9

***Future Trends in Microelectronics: The Nano, the Giga, and the Ultra*** **offers another insightful look into the future of the microelectronics industry, as envisioned by top lithographic-centric experts.**

The book is derived from the Fourth International FTM Workshop, a forum for informal exchange of microelectronics research and ideas, and brings together collective expertise from industry, academia and government.

Although it is certainly not focused on manufacturability, or packaging, per se, it will provide the reader with a glimpse of some likely materials and feature-size challenges they can expect.

**WELCOME TO THE 'NANO AGE'**

The future of today's mainstream silicon technology in the "Nano Age," including expected "ultimate" silicon device structures, their applications and various potential technological roadblocks is covered in Part 1. The authors assume silicon will reach limits, as have others over the years.

Discussions of alternative materials and novel technologies abound in Part 2. Spintronics, molecular electronics and superconducting electronics that may find a role in mainstream technology when silicon reaches its limits, if ever, are addressed.

Part 3 describes bleeding-edge activities with lasers and quantum dots. The emphasis is on rapidly developing terahertz sources and applications.

**Anyone involved in microelectronics manufacturing should find these scenarios thought provoking.**

What's the future beyond ever-smaller silicon devices? Is there practicality in the fashionable topics like quantum computing, molecular computing, spintronics, and similar research trends? What is the most likely future of microelectronics in the near and long term? Read this book, and draw your own informed conclusions.

**EXTRA!(TM)**

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