



Semiconductor Industry Solution

Background

Silicon technology has been the economic driver for much of the Information Age, by providing a 25-30% year-to-year improvement in cost per unit of performance. This amazing performance has been fueled by constantly improving semiconductor technology, including major gains in design and manufacturing automation. However, semiconductor manufacturers face market and cost pressures that are among the most severe of any industry.

No margin for error

Although demand for semiconductors is expected to exceed manufacturing capacity, prices for building and outfitting new wafer fabrication facilities have already surpassed a billion dollars. While chip features shrink to less than 0.25 microns and wafer diameters move from 8 to 12 inches, costlier equipment with more stringent manufacturing and contamination tolerances is likely to push the required investment to two or more times today's costs.

Time-to-market requirements are forcing the implementation time for new fab lines and processes to shrink from 24 to 12 months, or even less. Meanwhile, global market competition continues to drive down finished product prices, while the demand for ever-improving quality and performance remains high. There is virtually no margin for error.

To survive and prosper in this relentless environment, semiconductor manufacturers have a critical need to improve asset utilization, reduce cycle time, improve yields, and manage the information generated throughout their facility, and particularly in the fab.

Around the clock operation a must

State-of-the-art IC fabrication occurs in facilities that can cover more than 100,000 square feet, the heart of the operation being an ultra-sterile clean room outfitted with extremely sophisticated and costly equipment. Investment in capital equipment and plant is so high that even slight interruptions in production can result in millions of dollars of lost revenue. In highly leveraged operations, production downtime can cost as much as \$1 million per hour.

The semiconductor industry has always led the high technology world with its efforts to establish highly controlled manufacturing environments. From upstream silicon wafer fabrication, to the midstream integrated circuit factories, to the downstream packing, testing and assembly plants, all procedures are conducted to achieve the highest accuracy and efficiency possible.

This requires the entire manufacturing process to adhere to and sustain very stringent process control. To further boost throughput, an integrated, enterprise-wide information management systems is essential. The enterprise system performs WIP tracking, BOM/resource tracking, material transfer, statistical process control, engineering data analysis, preventive maintenance scheduling, and enables the retrieval of real time production information.

The process of manufacturing semiconductors, typically consists of more than a hundred steps, during which hundreds of copies of an integrated circuit are formed on a single wafer. To achieve maximum productivity in the fab, a high degree of control over the materials, process steps, and cleanli-

ness of the production environment is essential. Keeping the manufacturing process under control requires collecting all of the disparate data involved in 100-plus step fabrication cycle - such as defect data, review station data, image data, WIP tracking data, including equipment and operator ID, in-line dimensional data, electrical parametric data, product test data, bitmap data, and wafer scrap information - and placing it into the enterprise database.

Non-automated workflow tracking: always a day late

Although more and more facilities have adopted enterprise data management systems, many still operate with non-automated process tracking procedures. A typical non-automated process tracking system would look something like this: When a wafer lot goes from one operation to another, an operator tears off a ticket and puts it in a box. Every 24 hours a production-control group picks up the tickets, updates the lots' activity, and publishes a work-in-process report about what had transpired in the previous 24 hours.

The short comings in such a system are obvious: production information is 24 hours behind reality, and approximately four to six hours are required to update the data and generate a report - making the report unusable for controlling inventory or production.

With real time data logging, all lot activity is updated by the operators in real time as each lot moves through manufacturing. Critical process information is captured and recorded at each step. If parameters are outside of specification limits, appropriate personnel can be alerted for corrective action, or automatic action may be implemented, and yield-analysis data is continually available.

Many IC fabricators have automated clean room data logging by installing industrial touch screen terminals, or clients, networked to the enterprise server. The results are impressive. Cy-

cle times have been reduced by a staggering fifty percent and manufacturing yields have increased more than 10%.

Insight goes beyond touch screens

Inroad Insight, the wearable thin client, has the potential to reduce cycle time and increase yields even more dramatically.

The Insight is a wearable, battery-powered, full-function client that networks to the existing enterprise server via a wireless LAN. Insight's user interface - speech recognition/speech synthesis - means that the operator can enter or access enterprise data while his or her hands and eyes remain free to perform the task at hand without interruption - increasing safety and efficiency.

Insight is easy to set up, easy to use, small, comfortable, light weight - and rugged enough for the most demanding production environments. It can be worn comfortable and unobtrusively inside the most restrictive cleanroom garb. The thin client is worn on a belt or holster and has a wired connection to light weight stereo headphones with an integrated noise canceling mike and micro-miniature SVGA monitor. A wired remote control allows placement of the thin client anywhere on the worker's body.

The full color, micro-miniature SVGA display sets the Insight completely apart from all other wearables or mobile computing devices currently on the market. Mounted to the headphones on a slender boom similar to the microphone, it floats unobtrusively a few inches in front of the user's eyes. Patented, built-in optical magnifiers make the tiny display appear as large as a bright, high-resolution, 17-inch monitor. This patented design allows the user to focus on the display when needed, or to look past the display when the eyes are required for other tasks.

Its superior hands-free ergonomics allows all of the reporting functions that would normally take place at a touch screen or key board to be performed without interrupting the task at hand. The operator uses the most natural interface, speaking, to record process data, while hands and eyes remaining free to work and the operator is free to move around the fab as needed. At the same time, a patented browser allows the operator to request and view batch or lot documentation, or any other documentation available on the enterprise server.

The ideal clean room IT solution

Insight is an ideal solution for the fab's unique IT needs:

- Space is at a premium in the clean room - Insight does not require any clean room real estate.
- Touch screen terminals require an extremely costly infrastructure of non-emissive wires. Insight is wireless. It uses an RF LAN to connect to the enterprise server, allowing the user to move freely anywhere in the facility.
- Insight conforms to network standard architecture and is compatible with the available MES software.
- Insight is sealed against radiated EMI and static discharge to protect the clean room's EMI-sensitive equipment.
- To enable paperless operation, the Insight's I/O port allows an interface with peripherals such as cursor pointers, barcode scanners, digital cameras, and wafer counters.
- Insight is rugged and reliable: up to the demands of a 24-hour-a-day production facility.
- Insight's RF LAN supports a high volume data transfer.
- The SVGA display can fully support graphic-intense applications.

Insight can take IC fabrication into the future

Today, a competitive IC manufacturing facility produces 3000 wafers per week at a cost of \$750M (where \$500M is for equipment alone). The cost of building new fabs, now in excess of two billion dollars, continues to grow while chip price pressures increase and qualified engineers become more scarce. The increased need to become more cost competitive is driving improved efficiency of their existing semiconductors tool set, which translates directly into reduced downtime and better utilization of manufacturing operation.

Process control at all points in the manufacturing operation is essential and can only occur when workers and processes are connected to the enterprise database.

Inroad Insight, the wearable thin client, connects cleanroom workers the information they need to perform a task as they actually perform the task, it integrates procedures, information, and tools, allowing them perform their work more safely and efficiently, eliminating interruptions and redundant data entry.

In addition, Insight allows managers to have immediate access to the latest operations data from anywhere in the plant enabling them to utilize their personnel and resources most effectively.

Inroad Insight gives IC workers a powerful new tool that can improve asset utilization, reduce cycle times, improve yields, and optimize workflow processes and provide managers immediate real time access to the information generated throughout the facility - allowing your IC facility to operate at peak efficiency and profitability. ♦

Specifications

- Rugged and light weight (less than 1.5 pounds), splash and spray resistant.
- Cushioned headphones with integrated display, noise-canceling microphone, and antenna.
- Ergonomic harness designed for worker comfort and safe cable management. Wired remote control permits placement of client unit anywhere on body.
- Industrial environment speech recognition and speech synthesis with application-specific vocabularies for hands-free operation.
- Optically enhanced micro-display emulates 17-inch, high resolution monitor.
- High capability RF LANs allow facility-wide freedom of movement.
- High speed RISC processor with extremely low power consumption.
- Four-hour minimum battery operation.
- Full support of Network computers standard. JAVA compatible.

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