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Texas Instruments TIRIS™ and Fluoroware Combine Efforts Behind the Scenes to Improve Chip Manufacturers' Yields

Behind the scenes in starkly lit, ultra-clean rooms, integrated circuit manufacturers, such as Motorola, Hewlett-Packard, and SGS Thomson, are upping the ante in the highly competitive semiconductor industry by using Texas Instruments TIRIS radio frequency identification (RFID) technology in a unique auto ID process control system developed by Fluoroware, Inc.

The need to keep everything antiseptically clean makes the use of RFID ideal since no hands are needed to make accurate reads. Many auto ID tracking systems, such as bar coding, are not as effective under the harsh chemical, clean-room requirements that semiconductor manufacturers face. Because lost goods and production downtime are very costly in the semiconductor industry, manufacturers in this industry face higher risks than in other industries.

Fluoroware, a company that specializes in providing solutions to semiconductor and other manufacturers requiring precise material handling, developed FluoroTracÆ, a patented, turnkey RFID-based system to eliminate product misprocessing, improve operator efficiency and increase equipment usage.

Misprocessing Can Be Costly

Wafers are the heart of manufacturing integrated circuits. One 8-inch wafer, for example, can produce from 100 to 1000 chips, depending on the type of chip being manufactured. Many fabs average 5000 wafer starts per week. That can mean 500,000 to five million chips per week per wafer.

If the retail cost of one chip is \$100, then the retail value of the chips on one wafer is \$10,000. Considering that wafer carriers normally hold 25 wafers and four carriers can be in a process simultaneously, the retail cost of misprocessing those four carriers is \$1 million.

Obviously, the value of tracking each carrier to eliminate misprocessing cannot be underestimated.

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Misprocessing Eliminated

In a fab clean room there can be as many as 800 places or 'readpoints' where a wafer carrier is moved from one step to the next. On occasion, wafers do get lost. Whether the wafer simply gets attached to the wrong lot, or the technician purposely loses it to hide mistakes, automatically tracking wafers, materials, and operators has clear financial benefits.

The FluoroTracÆ System verifies that the wafer lot, the equipment, the recipe, and the operator are all correct. If any one of these has the wrong ID, the equipment locks up and the operator cannot continue processing the wafers at this stage.

Improved Operator Efficiency

By automatically identifying the product at each step, The FluoroTracÆ System eliminates operator intervention to scan products or key in an ID number or an access code. This eliminates a possible source of errors.

RFID technology provides another advantage over other scanning technologies. No clear line of sight is required to read an ID. Operators wear a simple low frequency ID tag on their wrists underneath their clean room 'bunny suits'. Nor does the operator have to carry anything, such as a pen and chart, or a hand-scanner to record IDs: The RFID system is linked to the manufacturer's host system and database.

To start a process, the operator waves his or her wrist over the reader and presses the big yellow button. If the operator's ID does not match that which is in the host computer system for the wafer carrier's next process, a warning signal emits from the FluoroTracÆ system and the equipment cannot be started until the correct wafer lot is installed. Automating data input has real value in eliminating human error and wrongly coded lots.

Increased Equipment Use

Equipment readpoints are inside the equipment to identify the carrier prior to processing. No opportunity to misprocess the wafers is provided. Because the FluoroTracÆ system is integrated with the host computer system, equipment usage is increased. The FluoroTracÆ system provides information on equipment usage so that management can more easily eliminate bottlenecks and smooth production flows.

How It Works

RFID uses a reader/controller and a TIRIS transponder or tag to communicate bidirectionally without contact. Once data is collected, it can be sent directly to a host computer or programmable logic controller through standard interfaces. Or data can be stored in a portable reader and later uploaded to the host.

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When the RF module sends out a power burst through the antenna to trigger the passive TIRIS transponder, the transponder is activated to send back its stored data. The RF module's antenna decodes the data and the controller immediately stores it in memory. This whole process takes about 70 milliseconds.

RFID facilitates real-time tracking and routing. Reads take less than one-tenth of a second compared to one-tenth to two seconds for bar codes.

To the semiconductor industry, RFID is considered an emerging technology ripe with potential for managing the manufacture of chips.

The FluoroTrac® system assigns a unique ID number to each carrier, box or transport module. Sensors are located at strategic input and output areas of process equipment, storage areas, and transport locations. The system also includes materials control that tracks equipment position, storage rack or lot number for all wafer lots from start to completed product.

When material is transferred from one container to another for a new processing step, the system automatically assigns the material lot ID to the new container ID.

The tag, which uniquely identifies each wafer cassette, is encapsulated within a protective glass tube and then sealed in the cassette. Since the tag is batteryfree, maintenance-free and needs no line of sight, it can be embedded into the plastic.

The antennas sit on top of the equipment for this process. The reader, called the Master Controller, is placed out of sight, often in a service alley.

The flat antenna, which transmits a signal and receives its response from the tag, is placed directly into the input and output port of the process equipment. As a cassette enters and exits from the input-output ports, the process equipment detects it. The FluoroTrac® Auto ID System controller is responsible for communicating with the antenna and converting the tag ID into a lot number. This number is then sent to the fab database, which specifies the required operations for every cassette at each step of processing. The database also controls each piece of process equipment. Lot location information is maintained and continually updated.

Results

Wafer yields are up at plants using the FluoroTracÆ system and data is automatically captured and reported, minimizing paperwork and errors and providing substantial return on investment to manufacturers.

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Note to editor: TIRIS (Texas Instruments Registration and Identification System) is an advanced radio frequency ID technology that includes both passive, low frequency transponders, active,

high frequency transponders, reader equipment and software. Applications, including automotive antitheft systems, vehicle identification, security access, and automatic logistics management, and electronic toll collection systems.

Fluoroware Inc., which serves the semiconductor industry to safely transport costly and delicate products through the manufacturing process, is ISO 9001-certified and has state-of-the-art manufacturing facilities located on three continents, including sites in United States, Germany and Japan. Fluoroware's sales and support offices are located throughout the world.

For more information, please contact, David Barnes, Fluoroware, Inc. 3500 Lyman Boulevard, Chaska, Minnesota 55318, 612-448-3131, Fax: 612-448-5576.

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