Freescale Semiconductor Manufacturing Case Study

About Freescale

Freescale Semiconductor is a global leader in the design and manufacturing of embedded semiconductors for the automotive, consumer, industrial, networking and wireless markets. The privately held company is based in Austin, Texas, and has design, research and development, manufacturing and sales operations in more than 30 countries.

To meet its customer needs, Freescale combines strategic internal and external manufacturing sources. Today Freescale has six front-end wafer manufacturing sites and two back-end bump, assembly and test operations. Throughout the years, Freescale has been constantly improving product manufacturing processes, with an emphasis on cost reduction, cycle time reduction and acceleration of new product introductions.

The challenge

Freescale’s production process requires that thousands of individual cases carrying work-in-process semiconductor wafers move freely throughout the fabrication facility and go through up to hundreds of steps to manufacture a final product. Freescale Oak Hill Fab is Freescale’s 8-inch wafer manufacturing facility in Austin, Texas. The 80,000-square-foot factory makes microcontrollers as well as power management and radio frequency products for the wireless and networking markets. It has technology capabilities down to the 0.25-micron technology node.

When the Oak Hill Fab opened in 1990, it was the first production volume 8-inch factory in the world, featuring state-of-the-art material handling technology. But over time the original product transport system became obsolete and the capital cost to replace it was prohibitive. The factory needed an innovative, lower cost system.

In the Oak Hill fab, all lot cases are handled by operators in clean-room environments and require specialized attention and care. Each time a fabrication process is scheduled, the operator must first precisely locate and identify the appropriate lot, often on a rack among dozens of similar lots. After the lot is located, it is brought to the appropriate machine for its next step in the process.
Locating wafer lots in the factory is often time consuming. Thousands of semiconductor wafer lots are stored and staged throughout the various floors and processing areas at the Freescale Oak Hill facility. A lot is a small box-shaped container, which stores high value semiconductor wafers worth thousands of dollars. The tedious searching process leads to wasted labor and higher cycle time. It can take several minutes and even a half hour in some cases to find the right lot. In other situations lots can be misplaced or become lost. Not being able to find wafer lots in a timely manner can result in dispatch incomp[...

In order to address those critical issues, Freescale was looking for a complete solution that would provide accurate real-time visibility of work-in-process wafer lots in the entire fabrication facility. Freescale’s key considerations were:
- A solution that will be comprehensive enough to address current requirements yet flexible to cover future requirements
- Low cost of ownership; installation costs and recurring costs, ideally leveraging its current Cisco Wi-Fi (802.11) network infrastructure
- Fast deployment with no disruptions to on-going production

After fully considering the options and evaluating various real-time tracking solutions, Freescale chose a Wi-Fi-based Active RFID solution from AeroScout.

The AeroScout Solution

Using the latest radio frequency identification (RFID) wireless technology, Freescale, in conjunction with AeroScout, designed an innovative and cost-effective solution to specifically meet the complex needs of semiconductor manufacturing.

“Given the high production volumes in semiconductor manufacturing and speed-to-market requirements, it’s essential that our facilities move work-in-progress products throughout the manufacturing process as quickly as possible,” says Chris Magnella, operations manager for Freescale’s Oak Hil Fab “The AeroScout solution is especially attractive in that it can use our Wi-Fi network without impacting existing operations, and has been embraced by our fab’s operators due to its ease of use.”
With the AeroScout solution, Wi-Fi-based Active RFID tags are attached to all wafer lots, enabling Freescale complete visibility of thousands of those lots on racks or as they move freely throughout the fabrication facility. Knowing the location of work-in-process inventory directly impacts production efficiency and helps to ensure that the correct lot is transported on time to its correct destination.

AeroScout tags communicate over Freescale’s existing Wi-Fi network. Using the standard WLAN network avoids potential radio interference with sensitive manufacturing equipment and also eliminates the need for costly and invasive rewiring. Advanced AeroScout algorithm is used to determine precise location, without interfering with standard network traffic (AeroScout’s Wi-Fi tags do not require network association). “Exciter” devices, unique to AeroScout, provide higher accuracy that allows operators to pinpoint the exact rack and shelf on which the lot box is on.

AeroScout’s Web-based MobileView software provides the real time location for each and every lot box and its flexible API is tightly integrated with Freescale’s manufacturing scheduling system. So when fabrication operators are required to find a lot, the AeroScout solution provides them with accurate and most recent location information. In addition, to further shorten the process, the AeroScout tag mounted on the lot box is then triggered to visually identify itself in a distinct manner by making its LED’s blink rapidly, so when an operator walks towards the rack he can pinpoint the lot immediately.

Solution Benefits

With the AeroScout solution in hand, thousands of steps are carried-out efficiently providing significant improvement in retrieval time and ensuring production schedule is maintained. MES is updated with lot location in real time yielding more intelligent lot dispatching decisions and improvement in dispatch compliance (especially in the Photo-Lithography areas). Even when mistakenly misplaced, a lot box is easily traced back, minimizing the possibility for production delays and ensuring that customer orders are filled ahead of time.

“The payback has exceeded our expectation,” Freescale’s Magnella says. “82% improvement in retrieval time resulted increased throughput, and ‘on time delivery’ was improved by 13%”. 