



Total Wafer Carrier Solutions

*Realize bottom line profits with
carrier solutions that protect
your investments from the
front-end through to the
back-end of the fab*

Protect Your Investment

A container of 25 patterned, 300 mm semiconductor wafers may be holding \$750 thousand dollars' worth of technology. With that much invested, protecting the purity, safety, and security of the wafers is paramount to your business. Fortunately for semiconductor

manufacturers, Entegris provides full container solutions to monitor, protect, transport, and deliver those valuable wafers from the front-end through to the back-end of the fab.

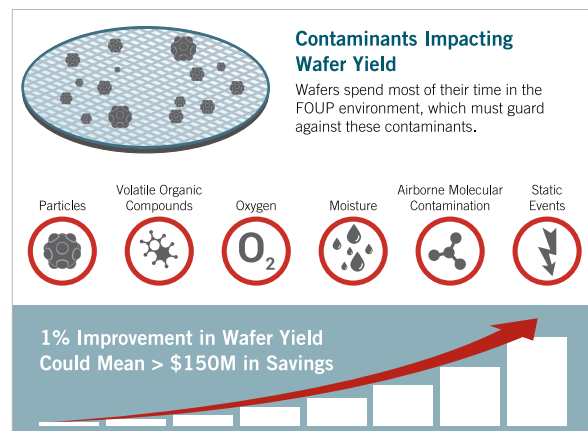


We help customers improve device yields by controlling volatile organic compounds (VOC), moisture, and oxygen contaminants.

Maintaining Contamination Control

The global semiconductor industry is racing to address ever increasing market demands for smaller, more powerful, and technology-laden devices. To address this rapidly increasing demand, semiconductor device manufacturers are facing processing challenges to improve yield and density while increasing layers and decreasing device line widths to 10, 7, and 5 nanometers. Controlling key influencers, such as contaminants that include volatile organic compounds (VOC), moisture, and oxygen, provides the opportunity to improve yield in current and future processes.

Semiconductor devices are manufactured using the most automated and technologically advanced processes in the world. From a wafer handling perspective, each critical transportation and process step requires unique materials, design, and carrier sourcing. While it might seem to make sense to prioritize the carrier cost over all other factors, it is equally important to control contaminants, quality, reliability, and availability. Calculations show that even a 1% improvement in yield can result in greater than \$100 million in bottom-line profit for the device manufacturer.



Controlling contaminants provides the opportunity to improve yield in current and future processes.

Relentless Pursuit of Purity

For more than 50 years, Entegris has developed broad capabilities in contamination control, high-purity materials, and material handling. Our relentless pursuit of purity has led to front opening shipping boxes (FOSB), front opening unified pods (FOUP), and horizontal wafer shippers (HWS) manufactured from scientifically engineered, custom-compounded

polymers with clean carbon loading designed to reduce contaminants. Utilizing manufacturing facilities and processes with stringent adherence to quality standards and to customer process change control requirements provides wafer carriers of the highest quality and assures supply continuity.

Total Container Solutions

The primary goal of the wafer carrier is to ensure safe transit, docking, loading/unloading, storage, and movement from point A to point B all while maintaining wafer cleanliness. To assure leading-edge performance in defect protection, it is paramount to understand the contamination challenges in each step of the wafer's process journey. Even small yield improvements can equate to hundreds of millions of dollars of profit annually. A key step to improving yields is sourcing wafer carriers designed to meet the most stringent semiconductor specifications.

Our in-depth knowledge of material sciences and process control, and history of design and innovation enable us to offer contamination-controlled, total solutions to support entire front-end to back-end device manufacturing processes.

SB300 FOSB

The [SB300 FOSB](#) provides the 300 mm wafer with a safe and completely automated journey from insertion into the carrier at the wafer manufacturer, through transportation to the fab.

Designed to protect the bare silicon wafer from numerous defects including particles, and ionic and volatile organic compounds (VOC) during shipment, our full-pitch FOSB is the first to be FIMS (front-opening interface mechanical standards) compatible. This means the structural and mechanical design achieves optimal performance through multiple wafer shipments while providing secure wafer control.

Molded-in wafer supports set this FOSB apart from the competition with precise and permanent wafer plane positioning for the entire life of the product. The product's structural rigidity protects wafers against vibration and shock events, reducing the opportunity for particle contamination and wafer misalignment, helping to significantly improve the final process yield.



The FOSB's materials of construction and mechanical design maintain product purity through multiple wafer shipments.

Total Container Solutions (continued)

SPECTRA™ FOUP

The [Spectra FOUP](#) holds 300 mm wafers safely and securely while they are transported and transferred 8 to 16 kilometers (5 to 10 miles) within the fab as they move through hundreds of sophisticated process steps.

Designed to address not only particles but to also minimize and control VOC, oxygen, and relative humidity (RH), these FOUPs provide superior microenvironment control, optimum automation integration, and low cost of ownership.

Hydrophobic materials of construction with clean carbon loading are designed for low moisture, and low volatile absorption and desorption. Generous radii in part design and open wash slots in the FOUP door cover eliminate water or moisture traps, enabling effective cleaning and reducing drying cycle times.

These advanced FOUPs create a sealed wafer environment that provides static protection, white-light shielding, and offers a considerable positive impact on device yield.



The Spectra FOUP, with advanced inert gas diffusion purge, protects wafers through hundreds of process steps.

SMARTSTACK® HORIZONTAL WAFER SHIPPER

The HWS has the job of safely carrying the very expensive and intricate finished wafer to its end customer. Our [SmartStack contactless HWS](#) completely separates the wafers with no force being applied to the subsequent wafer surfaces, protecting the highly sensitive, finished wafers from static, corrosion, and shock events during transport to their final destination.

These advanced wafer shippers are designed for automation with standardized KC-interface and hold down features to safely receive the wafers in a hands-free environment. Auto-loading compatibility and perimeter support rings encapsulate the wafer without touching the wafer surface.

Specially engineered polymers control against static discharge and enable safe transport and storage of 300 mm, 200 mm, and 150 mm wafers with protection from ionic contamination, outgassing, and mechanical elements.

Our HWS increases shipping density, which significantly reduces finished wafer shipping costs; and by addressing both edge defects and shipping damage our contactless design improves overall product yield. Protecting the purity, safety, and security of finished wafers is paramount since one wafer handling container of finished 300 mm wafers may be holding \$750 thousand dollars' worth of technology.



The SmartStack contactless HWS safely transports highly valuable and intricate finished wafers to their final destination.

Why Entegris?

Microchip fabrication is fraught with yield-impacting perils; your wafer-handling solutions should not be one of them. Not all carriers are the same in process control, contamination inhibition, cleanliness, usability, capacity, and durability, nor are all carrier vendors the same in terms of breadth of product offerings.

With our broad portfolio of microcontamination control, advanced materials handling, specialty chemicals, and engineered materials, we are uniquely positioned to deliver carriers on time with the highest quality and reliability. We are driven to help customers face their process challenges and meet new worldwide consumer and business data demands at lower costs.

Ongoing investments in technology, robust manufacturing, and supply-chain capabilities make us a proven, trusted partner. Our global infrastructure, technology portfolio, and operational excellence are unmatched by the competition. Investments in newer and purer materials enable us to provide not only the most advanced front-end to back-end carriers today, but to also design and deliver on the next generation products.



We help customers realize bottom-line profits by improving their productivity and performance with ultraclean components, reliable materials, and cost-effective wafer carrier solutions.

Experience You Can Count On

Contamination control is critical to your manufacturing processes and has a direct impact on production yields, product reliability, and operational efficiency. We focus on understanding your processes, sources of contamination, and on developing material-enabled solutions to ensure the cleanliness and integrity of those processes. We invest in identifying where impurities may be introduced, and take corrective actions to prevent

them, which is a critical first step in contamination reduction efforts.

Trust us to support your vital applications and goal for zero defects by providing the highest purity, highest quality, and most robust products. Our reliable, cost-effective liquid filters and purifiers provide a line of defense to prevent defect-causing contaminants in current and new technology nodes.



Our ability to innovate new technologies is based on our deep knowledge of materials science and analytics.

Proven Quality and Performance

At Entegris, we have a relentless commitment to operational excellence. Our desire to be a relevant, trusted, technology partner drives us to identify complex problems critical to our customers, quickly develop a working solution, and move from pilot to high volume manufacture (HVM) seamlessly in record time. In our pursuit to be the best performing operational platform in our market, we have aligned our Quality systems to industry requirements and provide capabilities to meet/exceed customer expectations.

Motivated to supply consistent and predictable product performance to customers, reduce quality excursions, and minimize scrap, we have invested in advanced statistical process control (SPC) systems across all our manufacturing sites around the world. Integrated SPC provides immediate recognition of special variation causes enabling faster problem resolution, providing early quality alerts, and allowing easier decision-making to ensure process consistency and minimize product variation.

Customer requirements are demanding so we are always striving for practical, quantifiable, sustainable continuous improvement. By employing lean Six Sigma techniques and tools, we identify and remove the causes of process defects that enable us to improve quality. By minimizing variability in manufacturing and business processes, our DPPM (defective parts per million) performance has also dramatically improved.

Ensuring product performance standards are met, proven techniques such as ISO 9001 certified manufacturing sites, documentation control, and quality testing are utilized. Each manufacturing capability has been developed, tested, and improved to create pure, durable, consistent, and reliable products.

- Injection molding
- Rotational molding
- Blowmolding
- Extrusion
- Tool design/making
- Welding and flaring
- Overmolding
- Prototyping
- Machining

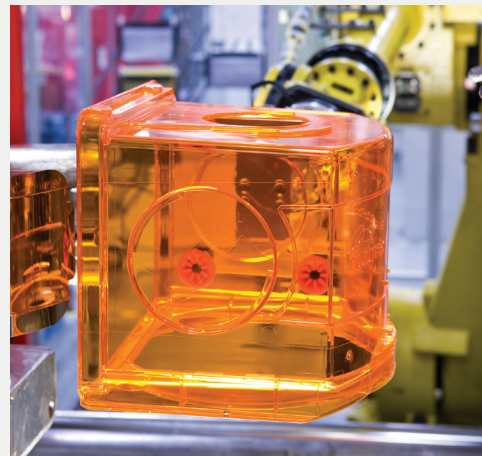
With nearly 2,000 issued U.S. and foreign patents, we have the expertise to develop process knowledge and products that enable innovation and efficiencies. Combining advanced engineering and design expertise with tools such as Finite Element Analysis (FEA), Computational Fluid Dynamics (CFD), and MoldFlow® analysis and modeling enables us to optimize product design and speed technological advancements. In addition to innovative design, we also use R&D and quality lab analysis and testing capabilities to develop dependable solutions.

QUALITY TESTING

- Vibration and shock
- Safety and industry standardization
- Trace metals
- Electrostatic charge

PERFORMANCE TESTING

- Particle testing
- Flow rate optimization
- Ion chromatography
- Failure analysis



We are dedicated to developing the purest products that assist in your goal for zero defects, and gain you the greatest operational efficiency.

Sales and Applications Support

Entegris continually invests in expanding analytical and technology center capability globally. Our global direct sales team, sales channel partners, local applications engineers, and world-class customer service give you the support and expertise to solve your most difficult problems. This intimacy allows us to better understand

your needs through direct feedback and roadmap sharing. By aligning our materials science, engineering, and R&D initiatives, we can develop indispensable contamination-control and high-performance solutions to solve your roadmap challenges.

eCommerce

Entegris has deployed an online purchasing and transaction management system that provides full eCommerce capabilities for our customers. For us, eCommerce is more than just a shopping cart, but rather a robust technology platform designed to deepen customer engagement and deliver value at every touchpoint. Driven by our customers' desire for

lower costs, improved accuracy, and overall increased satisfaction, we have implemented state-of-the-art tools and full integration with our back-end systems to allow automated access to information, accelerated and easier transactions, and a convenient means to collaborate and do business.

Logistics Expertise

To support your logistics requirements, we manage the infrastructure and service provider partnerships, offering broad capabilities to ensure your supply chain door to door. Providing import processing, insurance, and transportation, we bring expertise in air, ocean, LTL, intermodal, small package, and hazardous

shipments. You will receive in-house, regional logistic support in the U.S., Germany, Israel, South Korea, Japan, Taiwan, Malaysia, Singapore, and China. And our top-ranked freight partners provide import processing services and transportation to all the remaining locations around the globe.



Our global infrastructure with local R&D, manufacturing, and support focuses on specific customer needs throughout the world.

Corporate Social Responsibility

Entegris has a strong commitment to Corporate Social Responsibility and seeks to create value responsibly. We balance the demands of doing business with the need to protect the environment and its resources and to ensure the health and safety of our employees, customers, and the communities in which we work and live.

We are committed to applying these principles to product stewardship, environmental protection, employee health and safety, and plant security. In addition, we are committed to aligning our operations with the Electronic Industry Code of Conduct (EICC). Our new product development process is mindful of Department for Education (DfE) principles to ensure new designs meet customer and governmental material content restrictions, such as PFOA elimination, conflict minerals, and banned substances. We also work on developing strong relationships with our suppliers to ensure their commitment to EICC principles and product material content.

LIMITED WARRANTY

Entegris' products are subject to the Entegris, Inc. General Limited Warranty. To view and print this information, visit [entegris.com](https://www.entegris.com) and select the [Legal & Trademark Notices](#) link in the footer. Entegris does not warranty any failure in the case of customers using unapproved foreign components.

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