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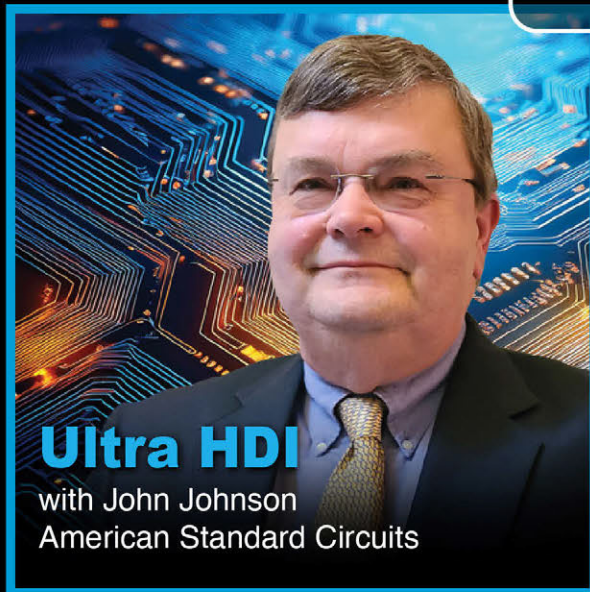
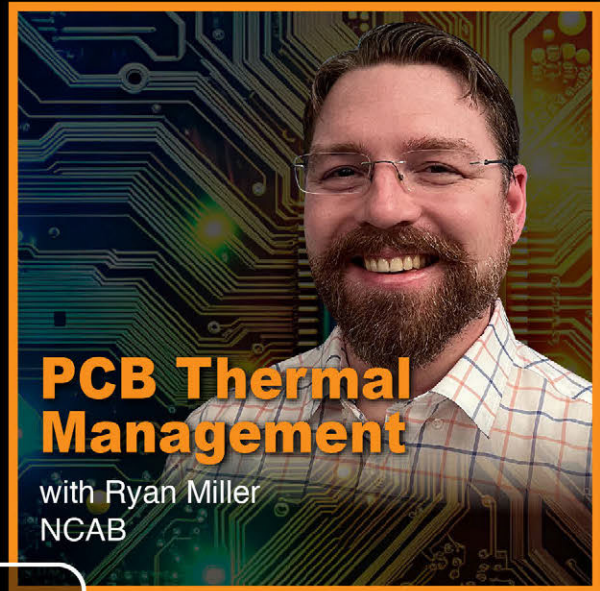
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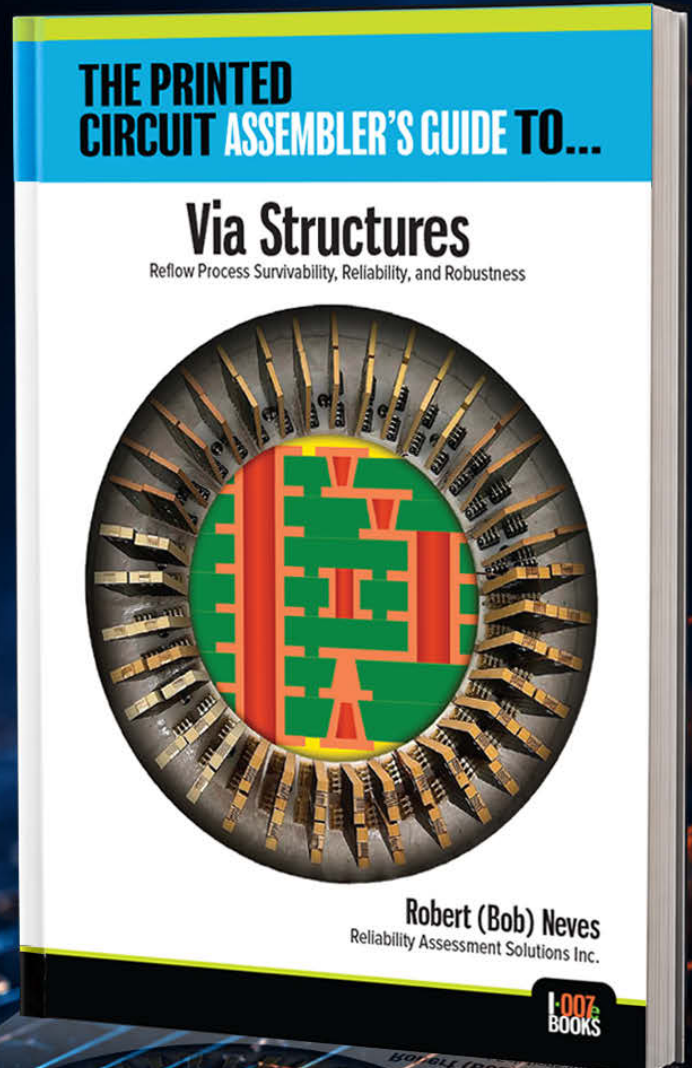
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Mexico's Time Has Come

As Mexico expands its electronics manufacturing capabilities, its value to the North American supply chain is proving to be about much more than nearshoring. This issue looks at what's driving investment in Mexico, the trade and sourcing decisions behind it, and what manufacturers are learning as they build a connected and resilient North American electronics ecosystem.

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Why Mexico's Time Has Come



BY NOLAN JOHNSON, I-CONNECT007

U.S. trade attorney James Kim recently pointed out that certain Chinese-origin IT goods can qualify for USMCA preferential treatment when shipped to the U.S. from Mexico, even when the Mexican operation consists only of sorting, picking, packing, and shipping. The provision, rooted in NAFTA Annex 308.1 and recognized in U.S. Customs and Border Protection rulings, gives Mexico a potentially valuable role as a gateway into the U.S. market and strengthens the case for further investment there.

So, what does that look like on the ground? We surveyed a variety of companies that represent the mix of electronics manufacturing in Mexico today and asked them about the country's climate. Their responses can largely be summarized in two words: "optimistic" and "legitimate." Mexico has been a legitimate manufacturing player for some time, of course, but there's a growing sense that it is evolving from a strong regional player to a strategically important global one. Find the results of that survey in this issue.

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Mexico increasingly serves as a low-cost gateway to the U.S. market for computer-related products and, as such, you can feel a shift in its four electronics manufacturing hubs: Guadalajara, Nuevo Leon, Juarez, and Tijuana-Mexicali. As the Mexican government invests in infrastructure that encourages more sophisticated electronics manufacturing, Mexico's leadership potential is rising. All one must do is visit SMTA Guadalajara, Oct. 7–8, to see what I mean. It's impressively large for a regional show, revealing just how much momentum Mexico carries. In this issue, SMTA's Ana Mendoza shares the why and how SMTA Guadalajara is important to the Mexican electronics industry.

Speaking of momentum, Mexico has opened an "overland canal" in the past few years, known as the CUII, linking the Atlantic to the Pacific on the Mexican isthmus. While this idea has had its starts and stops for more than 150 years, it seems to have found its time. Read my article on the history and strategic importance of the CUII, a corridor that not only offers an alternative shipping lane but also suggests that a manufacturing chain could easily develop along the route. In my research, I learned that recent low water levels in the Panama Canal have threatened canal operations, underscoring the importance of the CUII in Mexico.

To continue with the theme, I'm including interviews with suppliers building out their local presence in Mexico: Paul Lancaster talks about Heller and SEHO's investment in the Mexico market and

how a local presence improves their ability to serve their customers, while Chris Bastecki of Indium discusses his company's brand-new solder paste manufacturing facility in Guadalajara, built to improve product quality, delivery times, and cost savings for their customers. Jamie Noland discusses important training updates from Blackfox.

I'm also pleased to introduce a new column by Tianming Liu, president and CEO of FS Quality and Fuji PCB, who will share his vantage point as a Chinese fabricator with Japanese training and a novel new plant in Thailand. Mr. Liu's insights will assist the entire electronics ecosystem in better understanding how cross-cultural manufacturing practices, efficiency standards, and communication styles are both unique and universal.

To that end, I see the ongoing evolution in Mexico as a key player in the global market. It is attracting foreign companies from more than just the U.S., locally owned companies are thriving, and changing trade agreements and shipping patterns create a bold new opportunity for Mexican-based distribution. It's not at all hard to see that Mexico's time has come. **SMT007**



Nolan Johnson is managing editor of *SMT007 Magazine*. Nolan brings 30 years of career experience focused almost entirely on electronics design and manufacturing. To contact Johnson, [click here](#).

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SMTA Guadalajara

15 Years of Advancement in Electronics Manufacturing

This year, **SMTA Guadalajara Expo & Tech Forum**, Oct. 7–8, marks 15 years of supporting and advancing the electronics manufacturing industry in the region. Over the years, the event has grown steadily in both attendance and industry impact, becoming one of the most important events of its kind in Latin America.

SMTA Guadalajara brings together OEMs, EMS

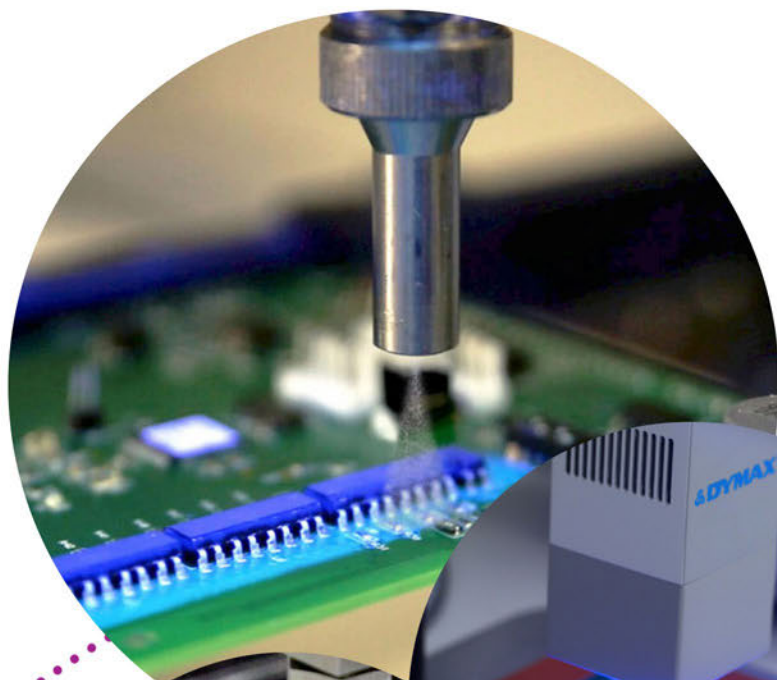
providers, suppliers, academia, and industry experts. As one of Mexico's largest electronics manufacturing hubs, Guadalajara provides the ideal setting for companies to discover new technologies, strengthen partnerships, and exchange technical knowledge.

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Growth is being driven by increased automation, digital manufacturing, AI-enabled quality systems, advanced SMT processes, and greater demand for high-reliability products in automotive, medical, aerospace, and industrial applications.”

ventions, manufacturing technologies, materials, and processes shaping our industry. It’s an opportunity for companies to demonstrate their investment in advanced manufacturing, automation, and workforce development.

Mexican Government Encouraging the EMS Industry

Mexico’s federal and state governments have supported manufacturing growth by promoting foreign direct investment, workforce development, infrastructure improvements, and trade agreements such as the USMCA. In Jalisco, collaboration among government, universities, and industry has helped create a strong talent pipeline and an attractive business environment. While companies continue to seek improvements in infrastructure and energy availability, government support has been instrumental in positioning Mexico as a strategic manufacturing destination.

EV Investment Diversifying

The investments made during the EV expansion have been leveraged beyond electric vehicles. Many facilities now manufacture products for automotive electronics, industrial electronics, medical

devices, telecommunications, and consumer electronics. As EV demand has evolved, manufacturers have demonstrated flexibility by serving multiple high-reliability markets while maintaining advanced production capabilities.

The Nearshoring Effect

In addition, the region benefits from nearshoring, with companies relocating or expanding operations closer to the North American market. Growth is being driven by increased automation, digital manufacturing, AI-enabled quality systems, advanced SMT processes, and greater demand for high-reliability products in automotive, medical, aerospace, and industrial applications. Companies are also investing heavily in workforce training to address the industry’s evolving technical requirements.

The Guadalajara Hub

The SMTA Guadalajara event provides a platform for technical education, networking, and business development. We offer practical knowledge through technical sessions while giving suppliers and manufacturers direct access to decision-makers. It also strengthens collaboration among industry, academia, and government, helping companies stay competitive in a rapidly changing manufacturing environment.

Another key focus is developing the next generation of electronics manufacturing professionals. Through partnerships with universities, technical institutions, and student programs, SMTA Guadalajara helps introduce young talent to the SMT industry, providing them with valuable exposure to emerging technologies and industry best practices. This strengthens the future workforce by helping students and recent graduates enter the electronics manufacturing industry better prepared to meet its evolving technical demands. **SMT007**



Ana Maria Mendoza is a senior manager at SMTA Mexico.

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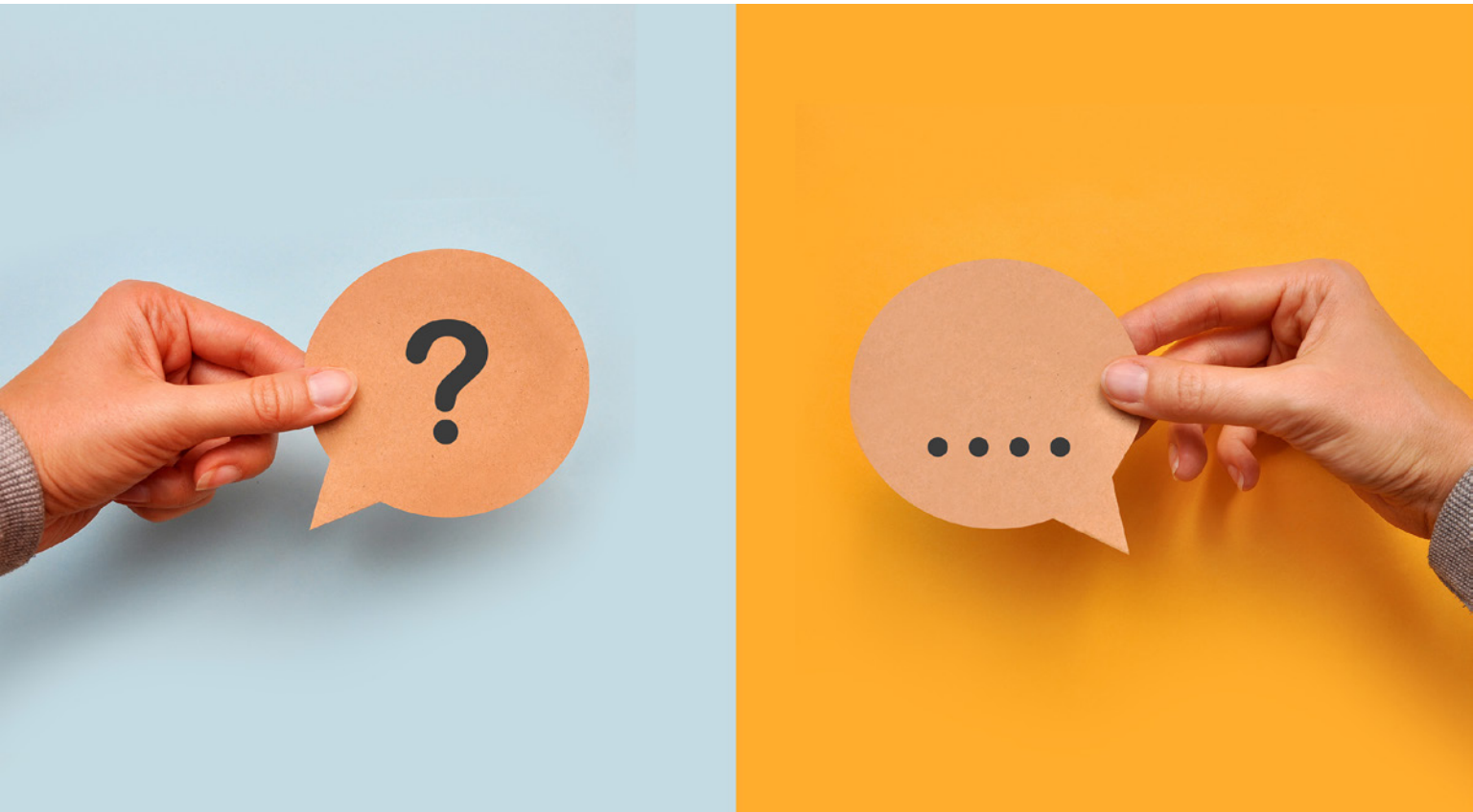
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Mexico's Manufacturing:

A Story Bigger Than Nearshoring



Mexico's electronics manufacturing story is often reduced simply to nearshoring. But companies operating within the country's manufacturing ecosystem describe a market moving beyond its reputation for cost-competitive assembly. They see deeper capabilities in engineering, automation, technical services, supplier integration, digitalization, and advanced manufacturing under development. And they want the world to know.

For *SMT007 Magazine*, we asked six organizations at different positions along the manufacturing value chain to share their vision. We asked them to describe their companies, the value they bring to customers, where they see growth, and how Mexico's place in global manufacturing is changing.

The responses were insightful and differed in emphasis, but we noticed several themes that suggest that Mexico is pondering its future capabilities:

- Manufacturers want partners rather than vendors
- There is a direct correlation between increased sophistication in production and the need for increased local technical capability; automation and digitalization are creating new opportunities
- Talent development is critical
- Mexico's next phase will depend on moving further into engineering, innovation, and higher-value manufacturing

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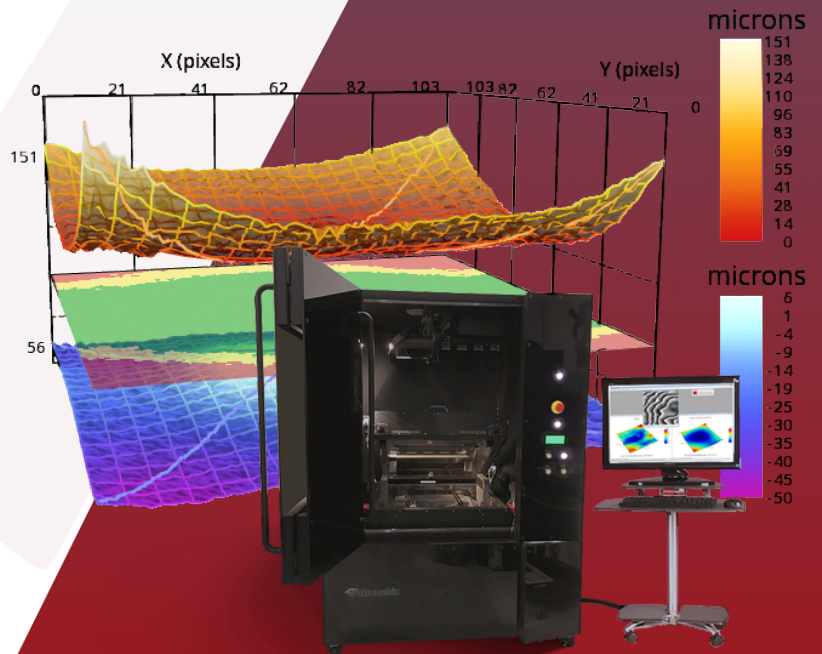
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The Ecosystem:

More Than Equipment and Capacity

Each company's mission recognizes that manufacturers need support beyond just a product or a transaction. Both recipients and providers in the survey recognize the importance. Consequently, each respondent's emphasis is on technical knowledge, integration, responsiveness, and the ability to help customers solve production and operational problems.

The Six Voices: An Introduction

1. **Maria Elena Gallego, President & CEO, Collectron International Services, Corp.**

Collectron was founded in Nogales, Sonora, in 1968 as a pioneer of the shelter model in Mexico. Its purpose is to allow international manufacturers to focus on production while Collectron takes responsibility for areas such as human resources, foreign trade, finance, legal and environmental compliance, facilities, and operational support. More than 350 manufacturing companies have operated under its model.



Maria Elena Gallego

2. **Jesús Duarte, President, Expo WireTech**

Mexico Assembly WireTech was founded in 2019 as a specialized platform for the wire harness industry and its manufacturing ecosystem. It has evolved from a trade exhibition into a broader business and networking platform that brings manufacturers, distributors, suppliers, industry leaders, and decision-makers together for business development, technical exchange, and collaboration.

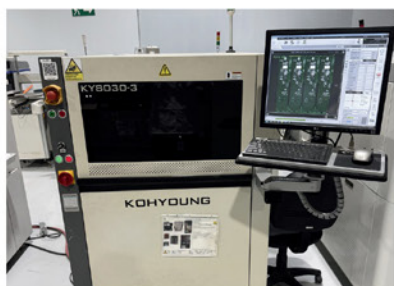


Jesús Duarte

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- SPEA 4060s2 Flying Probe Tester (2020)
- (6) Yamaha YSM20-2 Placement Machines (2017-2018)
- Yamaha Feeder & Cart Package (750+ feeders, 84 carts)
- Nordson Dage XD7600NT "Ruby" X-Ray (2016)
- (3) Pillarhouse Orissa SynchroDEX 460 Selective Soldering Systems (2021)
- Agilent 3070 Series 3 ICT, 2-Module, Fully Loaded
- (4) Heller 1913MK5 Reflow Ovens
- (3) Koh Young KY8030-2 SPI Machines (2017 & 2019)
- ShinMaywa Wire Terminating Group (TRD501 2021, TRS 353A, TRD111)
- PVA Conformal Coating (Delta 8 2018, (2) Delta 6 2017)



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3. Ignacio Lopez Arroyo, CEO, Repstronics
Repstronics says its evolution has been driven by a simple premise: Customers are not looking merely to buy machines; they are trying to solve manufacturing challenges. The company combines products from global technology partners with engineering expertise, applications knowledge, technical support, process optimization, and training.



Ignacio Lopez Arroyo

4. Frederico Teixeira, Industrial Director, Mexico & U.S. Operations, Ricardo & Barbosa
Founded in Portugal, Ricardo & Barbosa has grown from a precision tooling manufacturer into a global provider of advanced crimping solutions for the wire harness industry. It operates manufacturing facilities in Portugal and Mexico using the same manufacturing technologies, quality standards, and production processes, and serves customers in more than 34 countries.



Frederico Teixeira

5. Alejandro Solórzano Elorza, Manager for Mexico, ROCKA Solutions
Founded in 2018, ROCKA was created to meet demand for a supplier that could provide high-quality products along with close customer support, technical expertise, and integrated solutions. The company says its combination of specialized talent, regional presence, and partnerships with global manufacturers allows it to support customers across Mexico, the United States, Brazil, and other markets in the Americas.



ROCKA Solutions Team

YOUR SYSTEM IS LIMITING YOUR CEILING.

There are cracks in the foundation.
It may be time to stop working around them.

TAKE A LOOK AT HOW YOUR SYSTEM HOLDS UP:

01

BUILT ON OUTDATED ARCHITECTURE

Costly to maintain. Difficult to change.

02

DISCONNECTED ACROSS THE BUSINESS

Departments, data, and processes live in separate places.

03

NOT ALIGNED TO ELECTRONICS MANUFACTURING

Requires workarounds to handle high-mix contract manufacturing.

04

DEPENDENT ON SPREADSHEETS

Critical data lives outside the system, relying on manual effort and tribal knowledge.

05

STRUGGLES TO SUPPORT GROWTH

New contracts, industries, and processes push beyond system limits and capabilities.

WHAT TO EVALUATE →

cetecerp.com/industries/electronics-manufacturing-ems-pcba/

- 6. Filiberto Severiano Moreno, Founder and Managing Director, SMTLINK Solutions** SMTLINK was built around the idea that manufacturers need more than an equipment supplier. Its model combines engineering, SMT line integration, industrial automation, equipment and materials supply, training, laboratory services, supply-chain support, and MES and Industry 4.0 solutions. The company positions itself as a technology partner across the project lifecycle, from planning and implementation through optimization and ongoing support.



Filiberto Severiano Moreno (in blue shirt) with members of the SMTLINK Solutions Team.

The Responses

Each company's mission recognizes that manufacturers need support beyond just a product or a transaction. Both recipients and providers in the survey recognize the importance. Consequently, each respondent's emphasis is on technical knowledge, integration, responsiveness, and the ability to help customers solve production and operational problems.

Capability Comes From Sophistication

These survey responses suggest that nearshoring is not an accurate way to define Mexico's manufacturing future. Proximity can (and will continue to) attract manufacturing investment; sustained competitiveness, however, will depend on what happens after the investment arrives. Successfully developing technical talent, strengthening supplier channels, integrating automation and digital systems, and expanding engineering capabilities will be crucial to scaling sophisticated manufacturing operations.

There are some potentially conflicting trends, however. Automation/digitalization may seem to be at odds with the need to develop a wider and deeper pool of technical talent, for example. But the move toward engineering and technical services means more than just production experience; talent supporting design and engineering will be a critical need.

The respondents in this survey may view these challenges from very different positions in the value chain, yet their answers indicate that Mexico's opportunity is not simply to manufacture more; it is to capture more of the knowledge, engineering, technology, and value associated with manufacturing. **Continue to survey results.**

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What Manufacturers Want From Their Partners

“What is your unique value to your customer and the manufacturing value chain?”

“Partnership” appeared in all responses, consistently used to describe a practical change in customer expectations. As manufacturing becomes more automated, interconnected, and technically demanding, suppliers are being asked to understand the process, reduce risk, support implementation, respond locally, and stay involved after the sale.

Maria Elena Gallego, Collectron frames its role around taking responsibility for the operating environment surrounding manufacturing. Customers receive direct access to leadership, manufacturing-industry expertise, and support tailored to each operation, allowing them to focus resources on manufacturing while Collectron manages regulatory and operational requirements.

Jesús Duarte, Expo WireTech sees its value in creating a highly targeted environment where manufacturers, distributors, suppliers, OEMs, service providers, and decision-makers can connect. Participants gain access to a specialized network, market visibility, and exposure to technologies and trends that can lead to partnerships and business growth.

Ignacio Lopez Arroyo, Repstronics describes its differentiator as complete manufacturing solutions rather than individual products. Its portfolio spans SMT, wire processing, cable and harness manufacturing, assembly, marking, fiber optics, automation, inspection, and smart manufacturing. The company says customers most value technical expertise, responsive local support, and a long-term partnership approach.

Frederico Teixeira, Ricardo & Barbosa points to its ability to manufacture crimp applicators and tooling on two continents using the same processes, supporting consistent quality and lead times. Its technology is designed to increase productivity and reduce cost per crimp, while the company also emphasizes customized solutions, response time, quality, and long-term technical support.

Alejandro Solórzano Elorza, ROCKA Solutions says customers value close relationships, technical knowledge, responsiveness, and regional coverage. Beyond representing global brands, its role is to help customers select, implement, and support solutions that improve productivity, quality, and operational continuity while reducing risk and optimizing processes.

Filiberto Severiano Moreno, SMTLINK Solutions emphasizes hands-on manufacturing experience in SMT and THT processes, NPI, process development, continuous improvement, automation, and manufacturing support. Its goal is to function as an extension of the customer’s engineering team and provide end-to-end support from concept and implementation through optimization.

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Capacity Is Not Where the Growth Is

“Where do you see your greatest opportunity for growth?”

The growth opportunities identified by the respondents extend well beyond adding production capacity. Regional expansion is part of the forecasted growth outlook, but so are automation, digitalization, advanced tooling, aerospace, electric mobility, and talent development, driven by the operational infrastructure complexity required to manufacture in Mexico today.

Maria Elena Gallego, Collectron identifies two major areas: regulatory complexity and talent. As labor, tax, customs, and environmental requirements change, the company sees value in helping manufacturers stay compliant ahead of those changes. It also sees workforce development, leadership, flexibility, inclusion, continuous learning, and specialized technical talent as central to the next phase of manufacturing growth.

Jesús Duarte, Expo WireTech sees opportunity in the expansion of wire harness, automotive, electronics, automation, medical-device, and advanced manufacturing activity. Its growth strategy centers on connecting more domestic and international companies, increasing participation from OEMs and buyers, and helping Mexican companies integrate more deeply into global supply chains.

Ignacio Lopez Arroyo, Repstronics sees significant opportunity as manufacturers invest in automation, digitalization, and advanced manufacturing technologies to improve productivity and remain globally competitive.

Alejandro Solórzano Elorza, ROCKA Solutions to strengthen its position in Mexico while expanding its manufacturing-solutions portfolio and regional reach. Looking toward 2027 and 2028, it sees opportunities in the southern United States, particularly Texas, California, Arizona, and New Mexico, as well as Brazil, driven by investment in advanced manufacturing, electronics, medical devices, and automotive production.

Frederico Teixeira, Ricardo & Barbosa points to automotive electrification, North American manufacturing growth, and demand for more efficient and sustainable production technologies. It plans to expand adoption of its product and increase its presence in electric mobility, aerospace, energy storage, and other high-value industries. The company also identifies AS9100 certification for its Mexico facility as an important milestone in its aerospace strategy.

Filiberto Severiano Moreno, SMTLINK Solutions expects continued electronics-manufacturing expansion across North America to increase demand for technology partners with strong local support. Priorities include growth in Mexico and the United States, industrial automation, manufacturing digitalization, traceability, Industry 4.0, regional systems integration, and technical training and workforce development.



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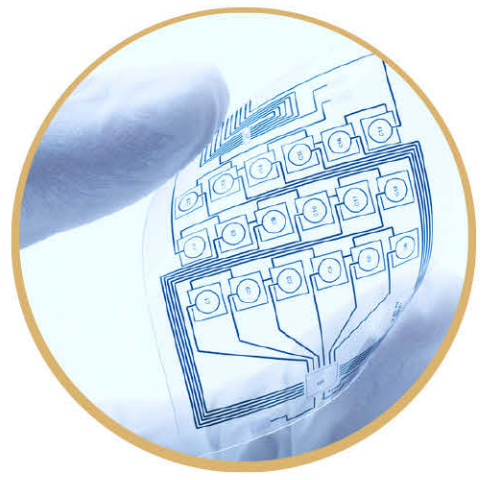
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Mexico's Changing Role

“How would you describe Mexico's changing role in global manufacturing?”

The six perspectives converge tightly. Mexico is still valued for proximity to North American markets, its industrial base, trade integration, and manufacturing workforce. But respondents repeatedly describe Mexico's steady evolution toward higher-value capabilities. Nearshoring may have been a catalyst, but the larger force is the transition from manufacturing location to strategic manufacturing partner.

Maria Elena Gallego, Collectron emphasizes the country's decades of industrial experience, mature supply chains, infrastructure, and skilled workforce. In its view, Mexico no longer competes solely on cost or capacity; it increasingly competes through engineering, design, automation, research, and development. The next challenge is to deepen technical specialization, develop more engineering talent, and strengthen collaboration among industry, universities, and workforce-development institutions.

Jesús Duarte, Expo WireTech describes Mexico's shift from a cost-competitive manufacturing destination to a strategic global manufacturing partner. Nearshoring is accelerating foreign investment and supplier development, but the larger opportunity is for Mexico to build leadership in innovation, supplier integration, technical specialization, and advanced manufacturing solutions.

Ignacio Lopez Arroyo, Repstronics also describes Mexico as a strategic manufacturing hub, citing its skilled workforce, industrial infrastructure, nearshoring activity, and investment in advanced manufacturing. As production expands, it expects greater demand for technologies that improve efficiency, quality, and automation.

Frederico Teixeira, Ricardo & Barbosa calls Mexico one of the world's most strategic manufacturing hubs for automotive, electronics, aerospace, and electrical industries. Its Mexico operation provides shorter lead times and localized technical support for North American customers while maintaining the same manufacturing standards used at its Portugal facility.

Alejandro Solórzano Elorza, ROCKA Solutions points to technical talent, manufacturing expertise, a strong supplier base, and proximity to North America as reasons Mexico has become increasingly important to global manufacturers. In ROCKA's view, Mexico has evolved from being primarily an assembly location into a strategic platform for production, integration, and exports across high-value industries.

Filiberto Severiano Moreno, SMTLINK Solutions sees Mexico becoming a strategic player in the global electronics supply chain, supported by trade integration, nearshoring, and engineering talent. Its view of the next step: strengthen innovation and automation while developing specialized suppliers capable of competing internationally. **SMT007**

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Why Global Manufacturing Is No Longer Optional



BY TIANMING LIU, FSQUALITY

Editor's note: This is a new column by Tianming Liu, president of First Quality Circuits Co. (FSQuality) and Shui Fuji Electronics Technology (Fuji PCB) that will appear monthly in SMT007 Magazine.

When we started our company in 2009, we made two practical commitments: build PCBs quickly and with consistent quality. Those principles became part of the FS Quality name and shaped how we developed our factories, trained our people, invested in technology, and served customers around the world.

Before founding the company, I spent 13 years working in Japan. That experience taught me

the importance of process discipline, preparation, attention to detail, and respect for customer requirements. It also showed me that manufacturing improves when people from different backgrounds share knowledge and combine their strengths.

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MacDermid Alpha
ELECTRONICS SOLUTIONS



and knowledge likely developed elsewhere. Global manufacturing is present in the machines we operate, the products we build, and the markets we serve.

This column, *Bridging the Pacific*, will examine that reality from the factory floor and engineering office. I will discuss global manufacturing from the perspective of someone who has spent his career building a company, solving production problems, working with international customers, and learning that trust is required for two companies to become true partners.

The True Meaning of Global Manufacturing

There is an important distinction between buying internationally and manufacturing globally. Buying internationally can be a transaction: A customer sends a drawing, receives a quotation, places an order, and waits for delivery. Global manufacturing requires engineering cooperation, shared quality expectations, clear communication, cultural understanding, technical transparency, and a commitment to solving problems together.

A PCB demonstrates this clearly. The product may be designed in North America, but the laminate may come from Japan, and the fabrication equipment may include technology developed in Europe, the United States, China, and other parts of Asia. The board may be manufactured in Thailand or China and assembled closer to the customer's final market.

The finished product is not the achievement of one country. It is the result of a connected manufacturing system in which every participant must perform well.

The Importance of Domestic Manufacturing

Global and domestic manufacturing should not be treated as competitors. A resilient electronics industry needs both. North American manufacturers provide proximity, specialized capabilities, quick-turn support, and close customer contact. International partners provide capacity, scalability, complementary technologies, supply-chain alternatives, and access to established manufacturing ecosystems. The strongest strategy combines these advantages according to the needs of each program.

During my career, I have seen international cooperation deliver results that would have been difficult for a single company to achieve alone: An engineer in one country identified a design concern, elsewhere a manufacturing team recommended a change based on their production experience, and a material supplier contributed data that helped everyone understand the issue. The result was a more reliable product because several organizations shared their knowledge.

This is productive globalization. It is not anonymous purchasing from a distant factory, but a coordinated problem-solving among people who may speak different languages but understand the same technical requirements.

Technical Work Creates a Common Language

A microsection, test result, process capability study, or failure analysis does not depend on nationality. The data supports the conclusion, or it does not. Customers must be able to understand how their products are manufactured, how quality is measured, and how problems are corrected.

A supplier should never expect trust simply because it has a modern factory, impressive equipment, or numerous certifications. Those qualifications are important, but they are the beginning of trust, not the end. I've learned from experience that trust grows when a supplier communicates honestly, protects the customer's interests, meets its commitments, and responds responsibly when something goes wrong.

Every manufacturer eventually faces a difficult issue, from changing materials to a design that reaches the edge of process capability. Other issues I've seen include rising demand, geopolitical uncertainty, health emergencies, and transportation disruptions. How does a responsible partner react to these situations? They should report situations quickly, explain them clearly, present practical options, and remain involved until the problem is resolved.

Customers do not expect perfection as much as they need honesty, competence, and accountability. They want a manufacturing partner that tells them the truth early enough for the information to be useful.

A resilient supply chain needs qualified alternatives. This does not mean constantly moving orders to obtain a slightly lower price. Rather, it's knowing which manufacturing partners can support each technology, volume, market, and risk requirement. The time to qualify a second source is not after the first source fails or when the preferred laminate becomes unavailable. Preparation is always less expensive than recovery.

We see our role as more than manufacturing boards based on a drawing. We must understand why the product is being built, where the technical risks exist, and what the customer needs. The correct manufacturing solution depends on the program. Geography is just one factor, not the only one.

Conclusion

My years of experience have taught me that a valuable global partner connects worldwide manufacturing capability with accessible engineering, responsive communication, transparency, and personal accountability.

That is the purpose of this column, and why I chose to talk about “bridges.” A bridge creates a dependable way to cross two sides. In manufacturing, that bridge is built from shared technical standards, trusted relationships, transparent information, and performance proven over time.

Companies should stop viewing their supply chains as lists of vendors and begin designing them as engineered systems. Every critical capability should have a defined purpose, a qualified connection, and a practical alternate path. We would never accept a circuit board where the entire function depended on one fragile connection. We should not accept a supply chain designed that way either.

SMT007



Tianming Liu is president and CEO of FSQuality and Fuji PCB.

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The Global Electronics Resource

Mexico Solders On With Indium Corporation

It makes sense to go where the customers are, which is why Indium Corporation recently opened a new solder paste manufacturing facility in Guadalajara, Mexico. Chris Bastecki, vice president of the Americas Sales and Service Group at Indium Corporation, as well as vice president of PCB Assembly Materials, discusses the reasons behind the new facility, the growing market segments, and the challenges of matching solder to specific applications.

Nolan Johnson: Chris, how does the new Guadalajara facility fit with Indium Corporation's mission?

Chris Bastecki: Initially, we will start with a limited range of solder paste products and expand over time to better serve the Mexican market. This adds capacity to our Utica, New York, facility, where we've been supplying customers for many years.



August 2026: Indium Corporation President and CEO Ross Berntson (third from right) and Guadalajara Plant Manager Barbara Esquivel (fourth from right) cut the ribbon to officially open the new Guadalajara location.

STRONG PARTNERSHIPS GROW LONG BEFORE THEY'RE NEEDED.

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When It Matters



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Every Step



YOUR SUCCESS
Is Our Priority



What is the opportunity for Indium Corporation to bring manufacturing closer to the customers who use it?

The Guadalajara site helps Indium in two important ways: First, our growth has been very healthy in the past five to 10 years, so we needed more capacity in the Americas. Second, Mexico is growing faster than other regions in the Americas, and we want to serve the Mexican market with low freight costs and responsive supply.

Solder paste is perishable, and generally, you need to use overnight air transportation to deliver the product. In Guadalajara, we're very close to a significant proportion of our customers, and we can deliver same-day or next-day at a very low cost, saving the customer a significant amount of money.

Why are you keeping your product list small to begin with? Is this in response to the type of product most often used in Mexico, and does it mean that production can be much more focused for the Mexican market?

Indium makes a broad range of alloys, probably broader than any other company, serving a variety of markets. However, the market in Mexico is primarily SAC305 and low-silver alloys, so that will be the focus of our initial offerings. These are the high-demand products the Mexican market requires.

Is the Guadalajara facility limited to just production?

Yes, it's a focused manufacturing site, although we will conduct some customer meetings and inside sales there as well.

Will you be manufacturing low-silver solder there?

Demand for low-silver products is accelerating. Since the second half of 2025, silver prices have increased dramatically, prompting manufacturers to seek lower-cost alternatives to SAC305, which contains 3% silver.

Reducing silver content can significantly lower material costs; however, it can also reduce thermal cycling reliability. PCB assemblers must therefore carefully balance cost savings with the reliability requirements of the intended end-use application to



come up with the optimal solution.

Not all applications can switch to a low-silver option, but many are completely suitable and meet all end-use requirements for thermal cycling, etc.

There is a variety of low-silver products depending upon the application and the tolerance for reduced thermal cycling. Indium offers a broad range of solutions that address the full range of end use requirements.

There is a strong presence for automotive in the Mexican assembly market. How does this impact Indium Corporation's product offerings and what it makes at the new Guadalajara site?

The Mexican market is strongly focused on the automotive industry for a full range of applications. Under-the-hood applications like ECU, TCM, PCM, and ADAS now require even higher reliability than you can achieve with the SAC305 alloy. These applications lend themselves to high reliability alloys, so that will be our focus in Guadalajara, too. However, a range of in-cabin and LED automotive applications offer excellent opportunities to explore low-silver alternatives and take cost out. They're high-volume, cost-sensitive applications, and low-silver comes into play there.

Many consumer products are manufactured in Mexico, especially white goods such as refrigerators, ovens, washers, and dryers, where the thermal cycling requirements aren't as stringent. In fact, there are many consumer-based applications used in controlled temperature environments that lend themselves to low-silver alloys.

What are some of the big drivers in the market right now, both in Mexico and globally?

The growth of AI servers is accelerating dramatically in Mexico and around the world. These applications present unique manufacturing challenges because they use increasingly large BGAs. While 50 mm x 50 mm packages are now common, newer designs can exceed 100 mm x 100 mm. Reflowing these large components creates significant challenges, in particular, high levels of warpage that can

The new Indium Corporation manufacturing facility in Guadalajara, Mexico.



lead to soldering defects and reliability issues.

Head-in-pillow and non-wet opens are two common warpage-induced defect types that are particularly challenging in AI server applications. As BGAs increase in size, they become increasingly susceptible to warpage during reflow, significantly increasing the risk of these defects.

Durafuse®LT is particularly well suited to these challenges because it reflows at a lower temperature, approximately 20°C lower than SAC305. Reflowing at around 220°C rather than 240+°C significantly reduces component warpage and, consequently, the risk of head-in-pillow and non-wet open defects. It also provides a tough, ductile solder joint. Many traditional low-temperature alloys can be brittle, making them more susceptible to fracture from mechanical and thermal shock. Durafuse LT is designed to provide greater resistance to this type of brittle failure.

Finally, the flux system is specifically engineered to help mitigate non-wet opens and head-in-pillow defects. By combining the advantages of this alloy with a purpose-designed flux system,

we provide a robust solution for the demanding assembly challenges facing today's leading AI server manufacturers.

Could having a local presence in the Mexican market influence some of your product development?

We're the second-largest supplier of soldering materials in the Mexican market, giving us a strong presence and a deep understanding of our customers' needs. Establishing local manufacturing will bring us even closer to our customers, allowing us to provide faster, more responsive support and greater supply-chain flexibility. There are always inflection points in technology that create new challenges and emerging needs. We embrace these challenges by developing innovative products that address technical gaps in the market.

Thanks, Chris.

You're welcome. **SMT007**

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U.S.A. IMPORTS FROM MEXICO



HOW THE PRODUCT MIX CHANGED FROM THE 2023 BASELINE TO EARLY 2026

Electronics and EV Components

U.S. imports from Mexico

\$475.6B

Full-year 2023

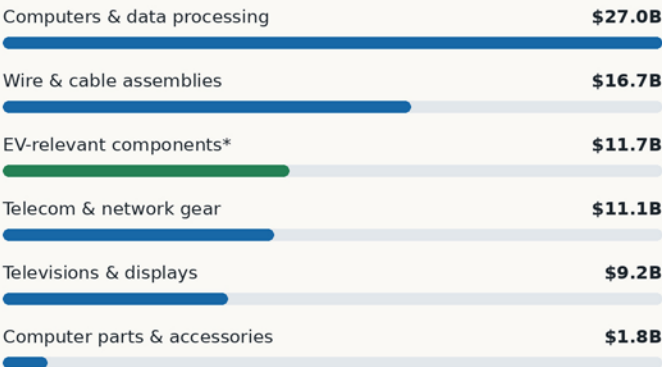
U.S. imports from Mexico

>\$138B

Q1 2026 · up 5% year over year

2023 baseline

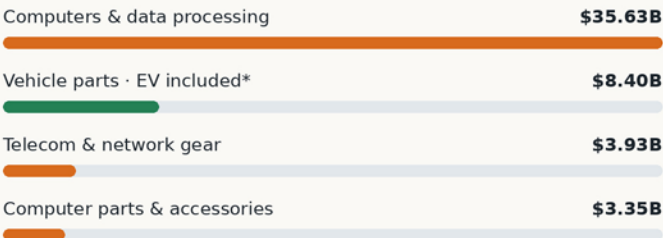
Full-year U.S.-bound value



Selected product total: \$77.5B. Computing represented 35% of this expanded mix.

2026 current trend

January-March only



Tracked Q1 total: \$51.31B. Computing represented 69% of this four-category mix.

* EV category scope

2023 combines electric motors, power electronics and documented battery products. These HS groups include non-EV uses. The 2026 value is broad HS 8708 vehicle parts—EV components are included, but not isolated—so the two bars are context rather than a like-for-like growth series.

AI hardware surged; EV supply remains strategic

Computers crossing from Mexico in the first three months of 2026 exceeded their entire 2023 value by \$8.6B, while broad vehicle-parts trade remained an \$8.4B quarterly lane.

\$50.08B · +95.6%

Mexico electronics-manufacturing exports
Q1 2026, all destinations

+165%

Computer-equipment export growth
Q1 2026 vs. Q1 2025

\$8.24B · +1.3%

Electrical-equipment exports
Q1 2026, all destinations

−3.4%

Automotive exports to the U.S.
Q1 2026, year over year

Nominal U.S. dollars. 2023 bars are full-year; 2026 bars are Q1 and are not annualized.

Selected HS groups: 8471, 8517, 8528, 8473, 8544; EV-relevant 8501, 8504 and documented 8507 products; 2026 vehicle-parts context 8708.

Sources: U.S. Census, WITS/UN Comtrade, TrendEconomy, TradeInt and INEGI.

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SAIC Awarded New \$70M Task Order for DoW Radar Engineering and Technical Support Services ►

Under this award, SAIC will deliver full lifecycle development and sustainment for mission-ready radar, radio frequency (RF), and microwave (MW) systems across surface, air, and maritime domains. This entails handling the design, engineering support, configuration management, and overall technical services.

Rocket Lab Awarded \$397M Space Force Flatellite Contract ►

Rocket Lab will launch the Flatellites on the Company's upcoming Neutron rocket and operate them from secure facilities, providing data and tracking information to the Space Force.

Heart Aerospace Completes First Flight of Largest Electric Aircraft ►

The flight took place on Wednesday, Aug. 12, 2026, at Heart's X1 flight-test base at Plattsburgh International Airport in Clinton County, New York. The company's X1 demonstrator aircraft, spanning 106 feet, measuring 76 feet nose to tail, and weighing more than 25,000 pounds at takeoff, X1 is the largest battery-electric aircraft ever flown.

Koh Young America Promotes Ramiro Mora to Lead Service and Applications in Mexico and South America ►

In his expanded role, Ramiro will lead the regional service and applications teams, creating closer alignment between technical support, process development, customer training, process optimization, and long-term customer success.

Sikorsky to Integrate MATRIX™ Autonomy into BETA Technologies' MV250 ►

Sikorsky and BETA formally agreed to this initiative earlier this month, and within two weeks, MATRIX autonomy was successfully integrated and flying BETA's CX300 conventional takeoff and landing aircraft, leading directly into MV250 development.

UK Invests in Homegrown Space Tech to Boost National Resilience ►

British businesses, universities, and researchers will receive access to more than £62 million in government funding to develop homegrown space technologies, boosting the UK's national resilience and helping protect its independence in a strategically vital sector.

Vertical Aerospace Makes History With First Public eVTOL Transition Flight at Farnborough International Airshow ►

At 1:46 p.m. local time, in front of a global audience of aerospace leaders, regulators, operators, and media, Simon Davies, Vertical's Chief Test Pilot, flew Vertical's full-scale prototype, completing a transition flight by moving from vertical take-off to wingborne cruise and back to vertical landing.

Raytheon UK Unveils Sovereign, Digitally Engineered Precision Weapon Red Kite ►

Developed with a consortium of British defence partners, Red Kite is an affordable, highly deployable precision weapon that advances the UK's ability to rapidly scale critical stockpiles. Using advanced digital modelling technologies, the effector quickly moved from concept to prototype.

Defense Speak Interpreted: Will Defense Become a Totally New Supplier for Drone Electronics? ►

"When I read recently that Tobyhanna Army Depot would begin manufacturing up to one million circuit cards annually for military drones, I immediately wondered whether this opens a whole new chapter of volume electronics manufacturing within Defense," writes Dennis Fritz in his latest column.

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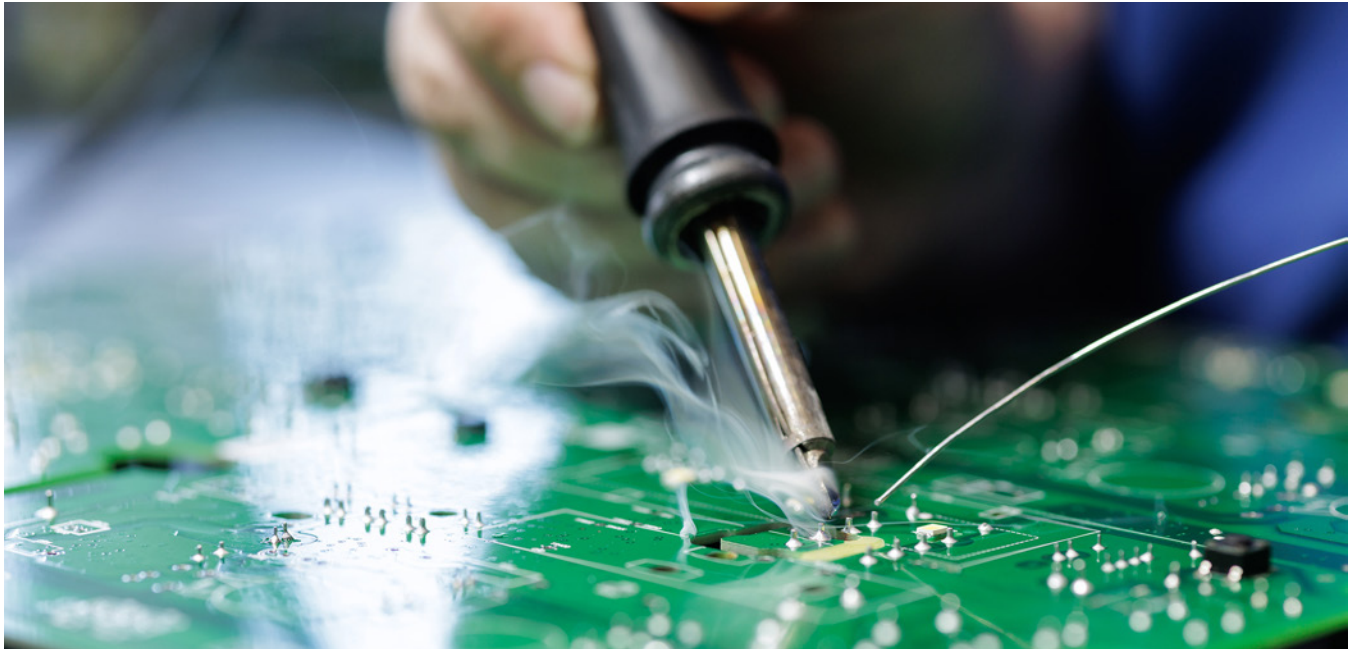
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The Human Side of *Latin American Electronics*



Latin America's electronics manufacturing ecosystem is at a pivotal moment. As global supply chains are reconfigured, the region has an extraordinary opportunity to capture more value, but only if manufacturers can meet increasingly stringent operational and quality demands. We contacted Blackfox General Manager Joel Sainz to discuss the human side of these demands. Skills training, as offered by Blackfox, is a critical part of meeting these increasingly complex demands.

What is driving the current growth opportunity for electronics manufacturing in Latin America?

Joel Sainz: Nearshoring and the need for more resilient supply chains have positioned the region as a preferred partner for North American and European markets. Geographic proximity and compatible time zones, particularly with the United States, can reduce logistical transit times from weeks to just days.

Which market sectors offer the greatest potential?

Several fast-growing sectors are creating demand for more sophisticated electronics manufacturing capabilities in Mexico:

- **Automotive electronics and electric mobility:** Mexico invested heavily in the shift to electric and connected vehicles
- **Medical devices and telecommunications:** Countries with established manufacturing clusters, including Mexico, Costa Rica, and Brazil, are attracting significant investment in products ranging from PCBs to high-precision medical equipment

Why is compliance with international quality standards so critical?

It's quite clear that failure to meet standards such as ISO 9001, IPC-A-610, and IATF 16949 for automotive production can have immediate and far-reaching consequences.

What are the most serious consequences of non-compliance?

There is a correlation between compliance and quality. The risks of non-compliance extend well beyond a single defective batch. Electronics suppliers operate within continuous audit chains. A serious quality failure can lead to removal from global approved vendor lists. Should a defective compo-

nent reach a life-critical end product, the resulting lawsuits, warranty claims, and penalties can threaten the survival of a small or midsize manufacturer. Repairing a PCBA or replacing components after assembly can cost far more than the part's original profit margin. Finally, multinational companies evaluate entire manufacturing regions. If local suppliers become associated with low quality or inconsistency, future investment may shift to competing markets.



How are Blackfox certification exams administered?

Theoretical assessments for Certified IPC Specialists (CIS), Certified IPC Trainers (CIT), and Certified Standards Experts (CSE) are administered exclusively through the official IPC EDGE platform. Blackfox does not control the exam questions or grading algorithms, so passing is based on the student's demonstrated knowledge.

How does Blackfox Training Institute in Mexico support the industry's need for qualified personnel?

Blackfox Training Institute in Mexico operates as an IPC Licensed Training Center and adheres to IPC's global requirements. Its model is designed to protect the legal and technical validity of each certification it issues while giving electronics manufacturers confidence that certified personnel have completed the required instruction and assessments.

What qualifications do Blackfox instructors maintain?

Courses are taught only by instructors with active IPC credentials for the applicable standard. These include IPC-A-610, J-STD-001, IPC-7711/7721, IPC/WHMA-A-620, and IPC-A-600. When a standard is revised, instructors complete the recertification required to teach the current criteria.

What will Latin American manufacturers need to succeed over the long term?

Installed capacity alone will not be enough. Manufacturers that combine regional advantages with disciplined, verifiable quality practices within the company will be best positioned to earn and retain customer confidence.

How does quality performance affect a company's ability to move up the value chain?

Strong quality performance opens the door to multi-year contracts with global OEMs. This enables manufacturers to progress from basic assembly into advanced design and engineering, and supports integration as direct suppliers. When quality is neglected, companies face contract cancellations, legal exposure, and replacement by Asian or European suppliers, and may be pushed back into lower-value labor roles.

Can employers and auditors verify the credentials issued?

Yes. Each certificate generates a unique registration number that can be traced through IPC's global database. This allows quality auditors from automotive, aerospace, medical, and other OEM organizations to verify a credential's validity.

How does the institute address hands-on training and practical evaluation?

For standards that require practical skills, such as soldering and inspection under J-STD-001 or rework under IPC-7711/7721, Blackfox uses test boards, components, and consumables that comply with IPC laboratory requirements. Its training laboratories also incorporate ESD controls and calibrated magnification and inspection equipment to replicate high-reliability manufacturing conditions.

What safeguards help ensure the rigor of the training process?

Blackfox follows the theoretical and practical instructional hours specified by IPC for each module. As a licensed center, it is also subject to IPC reviews covering commercial policy compliance, brand usage, and operational processes.

What is the practical benefit for manufacturers?

Centralized testing through IPC EDGE provides impartial assessments and internationally valid credentials. Approved practice kits support meaningful evaluation of soldering and inspection skills, while verifiable credentials help manufacturers prepare for customer audits in regulated industries, including automotive under IATF 16949 and aerospace under AS9100. **SMT007**

Heller and SEHO Investing in Mexico

Heller Industries is the leading provider of thermal systems in the electronics assembly and semiconductor industries, manufacturing a wide range of equipment, primarily for standard reflow applications in electronics assembly. The company has realized significant business growth in Mexico in recent years and is now preparing for SMTA Guadalajara. Paul Lancaster, vice president of sales and marketing, spoke about the Mexican market, building a local support infrastructure, and partnering with SEHO North America.

Nolan Johnson: Paul, what are some of the emerging opportunities or markets open to Heller?

Paul Lancaster: We do a wide variety of thermal products, primarily geared for electronics and semiconductor applications. For example, we make vertical curing ovens for areas where space is limited. We have vessel-based systems used in other applications in the semiconductor space, such as pressure curing or pressure reflow, and we also have automation solutions, whether we're curing through a magazine, recycling carriers, or substrate holders.

Given your perspective on circuit boards as well as semiconductors, are there shared trends? Are these sectors converging or diverging?

They're converging. They're highly synergistic; we see one as a leading indicator of the other. There's a fairly significant upturn across the entire business, driven in particular by the buildout of AI infrastructure and data centers.

The increase in wafer starts and new wafer capacity are positive signals of expansion, and capital equipment is also expanding into the fabs. Those are all leading indicators of what happens further on down the process. Once we pass the back of the line for semi, next is production increases in electronics assembly, where we're making the circuit boards, placing components, and reflowing them. That's when it all converges.

We're still midway through the CHIPS Act. Is semiconductor buildout a priority, or has it been overshadowed by AI buildouts?

The CHIPS Act was a good starting point. But the demand was missing, and now, with the AI infrastructure boom, that's really coming on board. Hyperscalers are the first movers, and they're aggressively ramping. That feeds into some of the fab expansions we saw resulting from the CHIPS Act, with several larger fabs under construction across the United States.

The key thing there, though, is the infrastructure around the fabs. With packaging, it needs to be developed locally, because making a die or a chip and then shipping it to Taiwan doesn't really solve the issue.

But I see an ecosystem developing around these fabs, and this is where we play on the semi side. Conversely, we are also seeing general infrastructure buildout. There is significant expansion in North America, primarily in the U.S. and Mexico, in reshoring and onshoring production capacity within the continent.

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What seems to be the overarching theme in Mexico's electronics industry right now?

Initially, there was significant buildout in the EV power electronics space. That continues as the EV market stabilizes. I wouldn't necessarily consider it a ramp down. It's continuing at a steady state of production volume. Now, there's a ramp as these hyperscalers build out infrastructure and rack assemblies for the cloud business. Mexico has been a major beneficiary of that.

Was some of the capacity that had been planned for EV market growth redirected to hyperscaler infrastructure?

The way the business is trending, there's very minimal reallocation from the EV to the AI infrastructure buildout. At Heller, we're seeing a huge uptick in overall equipment sales, which tells me that there is true capacity coming online rather than reallocation of existing capacity. Because of past cycles of boom and bust, there was always a tendency for companies to add capacity based on projected demand.

Now, though, companies are a little bit smarter about it. Customers won't preemptively put in capital inventory in anticipation. They'll put it in the inventory when it's needed. As an equipment supplier, though, lead times have decreased, and we need to respond quickly.

Among the three or four enclaves of electronics manufacturing around Mexico, where is the most active growth?

We're seeing it countrywide. Guadalajara, generally speaking, would always lead any time there is a growth cycle in Mexico. It's the center of anything electronics assembly-related. However, there's healthy activity along the entire border from Tijuana to Juarez, Matamoros, Reynosa, and everywhere in between.

The greatest volume is still centered in Guadalajara, where you have the largest installed base of electronics assembly lines, and the labor force to match. But the Maquiladora area in the border region is also experiencing growth and expansion.



Paul
Lancaster

Is Mexico moving up the capabilities chart from mostly final assembly into something much more sophisticated and strategically placed in the electronics and semiconductor supply chains?

I definitely see Mexico growing in terms of technology advancement, going from standard reflow applications to more advanced manufacturing applications. For SMT-related projects, there are more advanced types of processing. These boards are increasing in their complexity and size. The board itself is challenging. The natural follow-on is to augment that capability with a void spec that requires vacuum assistance to minimize voids. Vacuum-assist ovens are very complex, and Mexico has stepped up and grown in this regard.

The next evolution for Mexico is the advanced packaging sector. Having the fab locally but not the packaging doesn't make sense. Now we're starting to see movement into Mexico from the packaging world. It's still very early days, but it's a good signal. Mexico has a lot of capability, and other companies are recognizing that.

Of course, Mexico is a friendly country to the U.S. Keeping your work on the same continent and in the same time zone makes delivery easier and doing business less challenging than with overseas partners.

Do you foresee Mexico becoming the advanced packaging specialist for the Americas?

Yes, they have that opportunity. It's hard for me to say if it will develop in the U.S. or Mexico. It makes a lot of sense for Mexico to do that type of work. Mexico has much of the infrastructure and labor force needed to support that type of manufacturing at scale. There's some potential U.S. augmentation for advanced packaging, mostly near top-tier fabs. It will be a healthy split, but I think the majority will end up in Mexico.

Has the current U.S. administration's policies on tariffs and trade agreements affected Heller's ability to do business in Mexico?

Not so much. There's always a drawback to policy

disruptions and this hyper-volatility in trade and tariffs. It's hard to do business planning when policies are unpredictable, but overall, it has had the desired effect: Companies are expanding into the U.S. in part to mitigate the risks associated with import tariffs.

Fortunately, we're a large organization with factories located in China and Korea, and soon in India. That enables manufacturing diversity, allowing us to ship from whichever country offers the most favorable trade environment with the U.S. For example, during the first administration under Trump, we were able to divert our shipments into the U.S. from Korea rather than China. We've continued to ship primarily to the U.S. from our factory in Korea to avoid the significant tariffs imposed on Chinese-manufactured equipment.

The 2026 SMTA Guadalajara Expo & Tech Forum is October 7–8. What will Heller's presence be like there?

SMTA Guadalajara is like the APEX EXPO for Mexico and has emerged as a key show. Heller will be there in force and exhibiting equipment.

Because of the growth of the industry in Mexico, we are investing pretty heavily in infrastructure there. We want our partners and customers to know that Heller is ready to scale with them. We are demonstrating that through investment in infrastructure and people. We've added a demo center in Guadalajara with equipment to provide trials and training. We're holding seminars on advanced technology at our Guadalajara site as well.

Recently, we held an overview of formic acid reflow technology. This very advanced process is not yet used in Mexico, but it is used worldwide in more advanced power electronics. The message I want to bring to the Mexican market is that Heller is investing for the long term. We provide direct service and support, direct sales and logistics support, and thermal solutions not only for standard applications but also for highly customized ones.

I like to emphasize that Heller has more than 160 engineers globally to meet the challenges of any new application or process that customers and partners bring to us. We can usually find them a solution.

What is the sentiment in Mexico right now? Two years ago, we saw enthusiasm because the infrastructure was in place to accept as much EV business as they could get. Last year, it was more cautious when the EV business didn't come through as expected.

Next year, the big topic will be AI data center expansions and the amount of business and manufacturing capacity they're driving in Mexico. There will be some cautious sentiment, but the market data indicators are all very positive, suggesting this isn't a blip. We're very much at the beginning; this will be the start of a continuous buildout of capacity and manufacturing. There are shortages of memory chips and many challenges in processing some of the larger rack-system boards used in this cloud build-out.

Mexico has participated quite substantially in this, and I think much of the discussion at the show will focus on how to solve these challenges more on a technological basis. I don't think the focus will be on whether the business will be sustainable.

In that respect, it will be a great show. I like having those technology discussions because, at Heller, we're always innovating. We have new projects to address these upcoming challenges, and we have shared roadmaps with our OEM partners that subcontractors and Tier 1 EMS companies will be very interested in learning about at the show.

Tell me more about the work Heller has been doing with SEHO. How will it be presented in Guadalajara?

SEHO offers selective and wave soldering systems, which are highly complementary to our more [conventional standard reflow](#) and other applications. Heller and SEHO have entered into a global collaboration. Customers are looking for total solutions, making this collaboration synergistic and complementary. We share resources in both sales and service. We are also manufacturing a dedicated platform for them at our Shanghai facility, providing a more cost-competitive solution for the Asian market.

We've been joining forces on trade shows. At APEX EXPO, we co-exhibited with SEHO [and will continue to do so at SMTA Guadalajara](#). Heller is growing, we are investing in Mexico, and we're committed to being the partner that customers can trust to scale with them as they grow.

Paul, thanks so much, and good luck in Guadalajara.
SMT007

LG Electronics Expands Latin American Manufacturing

With New Smart Factory in Brazil

LG Electronics (LG) has opened a new plant in Paraná, Brazil, reinforcing its manufacturing footprint in Brazil and supporting long-term growth across Latin America, a key growth region for LG.

Representing an investment of approximately \$310 million (BRL 1.5 billion), the factory is LG's second home appliance production base in Brazil, joining the Manaus plant in Amazonas, which began operations nearly three decades ago. The new facility spans an area of approximately 770,000 square meters and has an annual production capacity of approximately 600,000 refrigerators, equivalent to one unit every 14 seconds.



Smart Manufacturing for Enhanced Productivity and Quality

The Paraná factory incorporates smart factory solutions, including AI and industrial robotics, to improve production efficiency, product quality and workplace safety. The facility applies LG's Vision AI-based inspection systems and robotics-enabled automation to enhance product quality and production consistency. Articulated robots are utilized to handle physically demanding or higher-risk tasks, such as transporting refrigerator doors, helping improve workplace safety while supporting process stability.

Refrigerators Tailored to Brazilian Lifestyles

The expanded production infrastructure will strengthen LG's ability to bring locally tailored home

appliances to market. Refrigerators made at the Paraná factory have been developed based on extensive local consumer research conducted by LG's Brazil-based R&D team. Comprising approximately 40 professionals, the team ensures that designs are optimized for Brazilian homes and lifestyles.

Additionally, the Paraná-produced refrigerators feature bi-voltage compatibility, reflecting Brazil's use of both 127V and 220V electrical systems. Engineered for the country's hot and humid climate and home-entertaining culture, the appliances also come equipped with LED-based internal sanitization to help prevent bacterial growth.

Strategic Production Hub for Local Supply and Regional Growth

The Paraná factory will initially focus on serving Brazil's domestic market by enabling the timely supply of locally tailored products. Manufacturing locally is also expected to improve logistics efficiency, reduce dependence on imports, cut delivery times by up to 80 percent, and strengthen LG's responsiveness to local market needs.

Over the mid-to-long term, the factory is expected to serve as a strategic production and export hub for Latin America, supporting regional growth while enabling the company to respond more flexibly to shifts in global supply chains and evolving market conditions. In practice, the plant facilitates shorter logistics timelines, providing LG with greater agility in supplying retailers and in reacting to seasonal demand and regional trends.

"The new Paraná factory strengthens our production capabilities, enabling us to ensure a stable product supply and deliver appliances tailored to the evolving needs of consumers in Brazil and across Latin America," said Baek Seung-tae, president of the LG Home Appliance Solution Company. "Through this strategic investment, we will continue to deliver differentiated customer experiences and reinforce our commitment to the region."

(Source: LG Electronics)



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Mexico's Answer to Bypassing the Panama Canal

In 2019, Mexico made a huge step toward economic development by creating the CIIT as a public body to integrate the ports of Coatzacoalcos and Salina Cruz with railway transport and regional development. The decree explicitly describes the project as a logistics platform linking those ports by rail and promoting economic development in the Isthmus.¹

After several significant construction projects, the 308.5 km rail line, the Interoceanic Corridor of the Isthmus of Tehuantepec, began operating in December 2023.² For electronics manufacturing, the value is not just the “new railway.” It is the value proposition for local manufacturing and global distribution created by this particular combination

of ports, railway, industrial parks, and tax incentives. All this development creates an attractive new manufacturing corridor along the CIIT.

Strategically, the CIIT gives Mexico's electronics industry Pacific access for Asian components, and Gulf/Atlantic access for U.S. East Coast and European markets. The CIIT corridor is being positioned as a logistics backbone for Mexico's electronics and semiconductor industries, not just automotive production.

This two-ocean logistics and manufacturing access should be attractive to the development of industrial zones for electronics and semiconductor investment. It is expected to become part of the supply chain supporting advanced packaging, PCB



The cargo ship, Bali Sea, loading up with trains at the port of Coatzacoalcos, Veracruz, in 2007. (Source: Creative Commons, Ferrosur)



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Figure 1: The CIIT's route over the Mexican isthmus.

fabrication, EMS operations, and chip assembly in southern Mexico and along the U.S.-Mexico manufacturing corridor.

Though the CIIT may have found its place and time in the global distribution networks, the CIIT is not new. Instead, it has a long history marked by multiple swings of fortune.

The current CIIT, long known as Line Z, is an old interoceanic railway. The present-day Line Z of the Tren Interoceánico now runs between Coatzacoalcos, Veracruz, and Salina Cruz, Oaxaca, across the Isthmus of Tehuantepec, but the route dates to the 19th century. The core idea has always been to use the Isthmus of Tehuantepec as Mexico's shortest overland bridge between the Gulf/Atlantic side and the Pacific. In the 19th century, this allowed ships and cargo to avoid the long route around South America via the Strait of Magellan.

The first effort in 1842 produced studies but no functioning railway. Throughout the mid-19th century, a series of Mexican, British, French, and U.S.-linked promoters sought concessions, but the projects stalled due to challenges including financial constraints, sovereignty disputes, geographic and climatic conditions, and labor difficulties.

Consequently, actual construction took decades. The first project, headed by Eduardo Learned, built only 35 km; later, Delfín Sánchez added 73 km, and Edward MacMurdo and Salvador Malo helped bring the line to about 251 km by 1893. In 1894, under the control of the Mexican government, the first through service was achieved. But because the line had been built in partial segments, and at different times, it struggled. It did not help that the ports at both ends lacked adequate maritime infrastructure.³



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The decisive upgrade came five years later, in 1899, when S. Pearson & Son Ltd. was granted a concession to renew, maintain, and operate the line, and add telegraph infrastructure. Perhaps most important, however, was fixing the terminal ports at Coatzacoalcos and Salina Cruz. It worked, and the route handled substantial interoceanic cargo and passenger traffic. But the opening of the Panama Canal in 1914 sharply reduced the line's strategic value.³

The modern CIIT is not a brand-new from-scratch railway; in other words, it is the revival and modernization of the historic Line Z trans-isthmus route. As such, the rehabilitation of Line Z began in 2019. Official project information lists 16 stations, three transfer yards, freight service, and scheduled passenger service.¹

The passenger opening was held on Dec. 22, 2023, when President Andrés Manuel López Obrador inaugurated the Line Z passenger service in Salina Cruz. Passenger service was temporarily discontinued in early 2026 after a derailment, but freight traffic continues unaffected.

One challenge facing CIIT is that existing manufacturing facilities are not located along the CIIT. Data México shows that Mexico's computer and electronic product manufacturing base is currently concentrated in states such as Baja California, Jalisco, and Chihuahua, with \$1.63 billion in FDI in the subsector during January to September 2024.⁴

Electronics supply chains depend heavily on the fast movement of imported components, assemblies, spare parts, and export-ready products. A company could import inputs from Asia through the Pacific, assemble or test in a CIIT development hub, and then move finished goods toward Gulf/Atlantic routes or onward into North America. In strategic terms, CIIT gives Mexico a southern nearshoring platform that complements the existing electronics

clusters in Baja California, Jalisco, Chihuahua, and other northern/western states.

The CIIT's long-term prospects for success include encouraging Mexican manufacturing to build out an ecosystem along the CIIT's route. This creates an express line wherein input goods arrive at either end, are transported to an assembly facility somewhere along the route, and then either transferred to the next step in production as local CIIT traffic or sent back to one of the ports for distribution as a finished good. This added accessibility is not possible along the canal, giving the CIIT a leg up as a pass-through manufacturing hub.

There are incentives as well. Mexico's Economy Ministry lists electrical and electronic activities and semiconductors among the eligible activities for CIIT Development Hubs, with benefits including accelerated depreciation, an aggressive income-tax discounts (100% for the first three years, 50% for years 4-6).

The CIIT is more than simply an overland alternative to the Panama Canal. The CIIT can, if well executed and embraced by manufacturers, help Mexico move beyond regional assembly toward a deeper role as a global supply-chain player in electronics, semiconductors, IT equipment, automotive electronics, and clean-energy components. The potential is there. Now it's up to all levels of government along the CIIT to attract and encourage manufacturers to develop the full vision of the CIIT. **SMT007**

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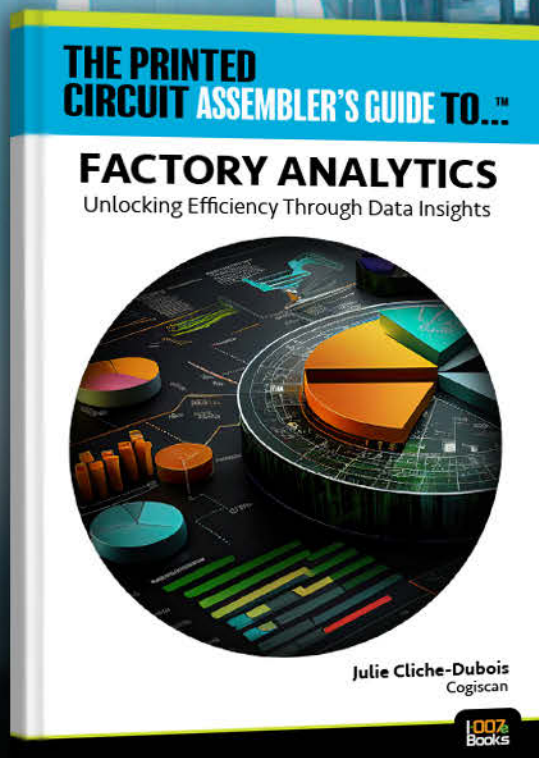
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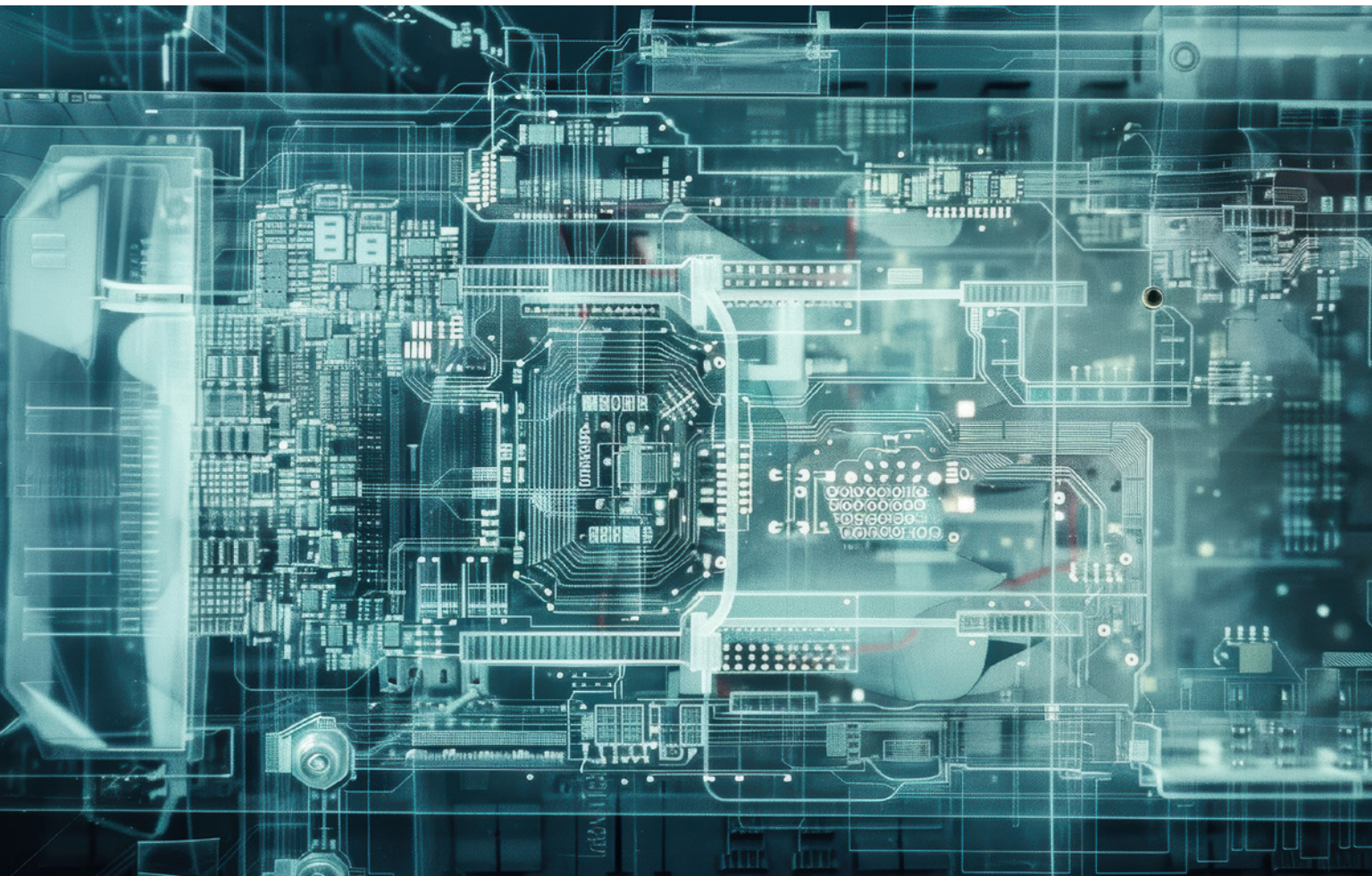
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Minimizing X-ray Dosage During PCB Inspection



BY NASH BELL, BEST, INC.

The ability to non-destructively inspect PCB assemblies is extremely important for verifying product quality without compromising the assembly. X-ray inspection provides a non-destructive method for examining optically hidden features that cannot be evaluated using automated optical inspection (AOI) or microscopic inspection. This makes it particularly valuable for verifying

solder joint interconnections beneath BGAs, chip-scale packages (CSPs), and other bottom-terminated components.

During X-ray inspection, electronic devices are exposed to ionizing radiation produced by high-energy photons and therefore receive a measurable radiation dose. Most PCB assemblies can be inspected safely using normal X-ray practices.

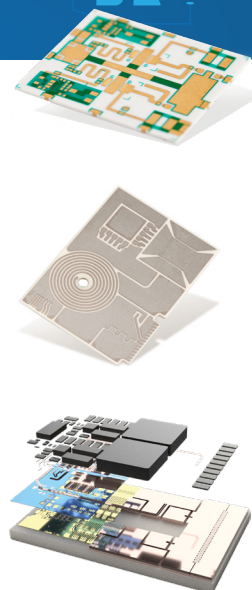
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However, certain semiconductor devices, including DRAM, flash memory, and other sensitive electronic components, may be susceptible to elevated or cumulative levels of ionizing radiation.

When sensitive devices are present, users may need to consider the total radiation dose delivered during the inspection process. This is particularly important when an assembly requires extended inspection times, repeated inspection cycles, or high-magnification imaging.

X-ray Fundamentals

An X-ray inspection system functions as an X-ray shadow microscope. X-rays produced by an X-ray tube pass through the sample and are received by an image-capture device or image intensifier.

Materials within the PCB absorb different amounts of X-ray radiation based primarily on their density, thickness, and atomic number. Materials that absorb more radiation create darker or more defined shadows on the detector, allowing internal

features to be evaluated.

Magnification is achieved by moving the sample closer to the X-ray tube's focal point. As the distance between the sample and the focal point decreases, the projected shadow increases in size. While this improves magnification, it can also significantly increase the radiation dose rate received by the sample.

Factors affecting the radiation dose delivered during X-ray inspection include:

- Distance between the sample and the X-ray source
- X-ray tube voltage, measured in kilovolts
- X-ray tube current and total tube power in watts
- Length of exposure
- Filtration placed between the X-ray source and sample
- Number of repeated inspection cycles

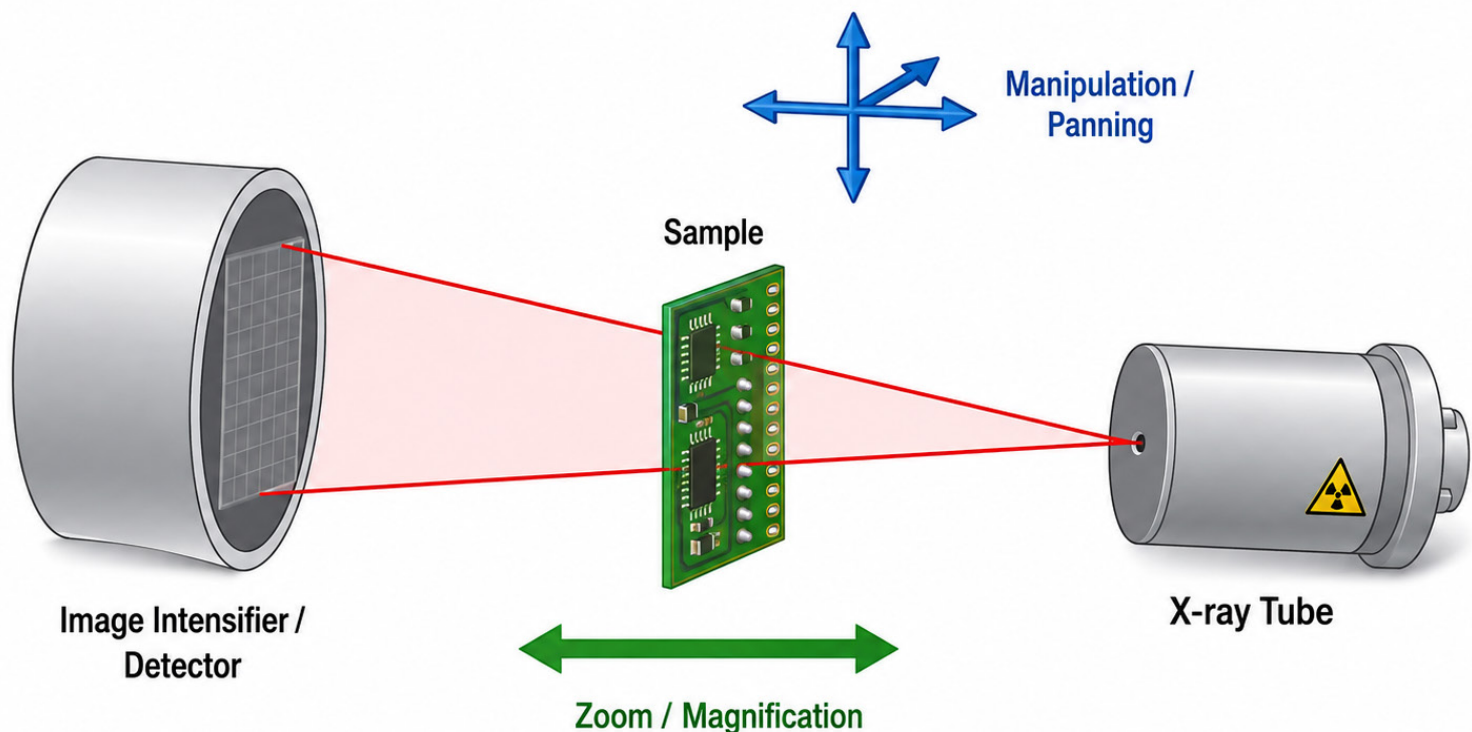


Figure 1: Basic X-ray inspection geometry and the relationship between sample position, magnification, and dose rate.

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The dose rate varies according to the inverse-square law. For example, if the distance between the X-ray focal point and the sample is doubled, the dose rate decreases to approximately one-fourth of its original value.

Solder Material Properties

The elements used in tin-lead and lead-free solder alloys differ significantly in atomic number, mass, and density. These differences affect how the materials absorb X-rays and how they appear within an X-ray image.

Because lead has a higher atomic number and density than the primary elements used in most lead-free alloys, tin-lead solder typically produces stronger X-ray contrast. Lead-free solder joints may produce different grayscale values and may require adjustments to the inspection settings.

Operators should avoid automatically compensating for reduced contrast by using unnecessarily high power, extended inspection times, or maximum magnification. These adjustments may improve the image but can also increase the radiation dose delivered to nearby semiconductor devices.

Radiation Effects

Radiation dose is the amount of energy deposited per unit mass of material. It is commonly expressed in Gray (Gy), where 1 Gy = 1 joule per kilogram = 100 rads.

Dose rate refers to the amount of radiation delivered over a given period and may be expressed as Gy per minute or rads per minute. The dose rate experienced by a device depends on its location relative to the X-ray source and the inspection settings being used.

Extremely large radiation doses can deposit enough energy into a semiconductor die to cause direct physical damage and device failure. However, these gross-failure dose levels are generally much higher than those produced during normal shop-floor X-ray inspection.

The more realistic concern is the potential for subtle or statistically occurring failure mechanisms. These can include bit flips, loss or corruption of programmed data, changes in erase margin, increased leakage, and changes in device performance or reliability.

Table 1: Fundamental properties of elements used in tin-lead and lead-free solder alloys

Element	Lead	Tin	Silver	Copper
Symbol	Pb	Sn	Ag	Cu
Atomic Number	82	50	47	29
Atomic Mass	207.2	118.71	107.87	63.55
Number of Protons	82	50	47	29
Approx. Neutrons	125	69	61	35
Density (g/cm ³)	11.34	7.31	10.49	8.96

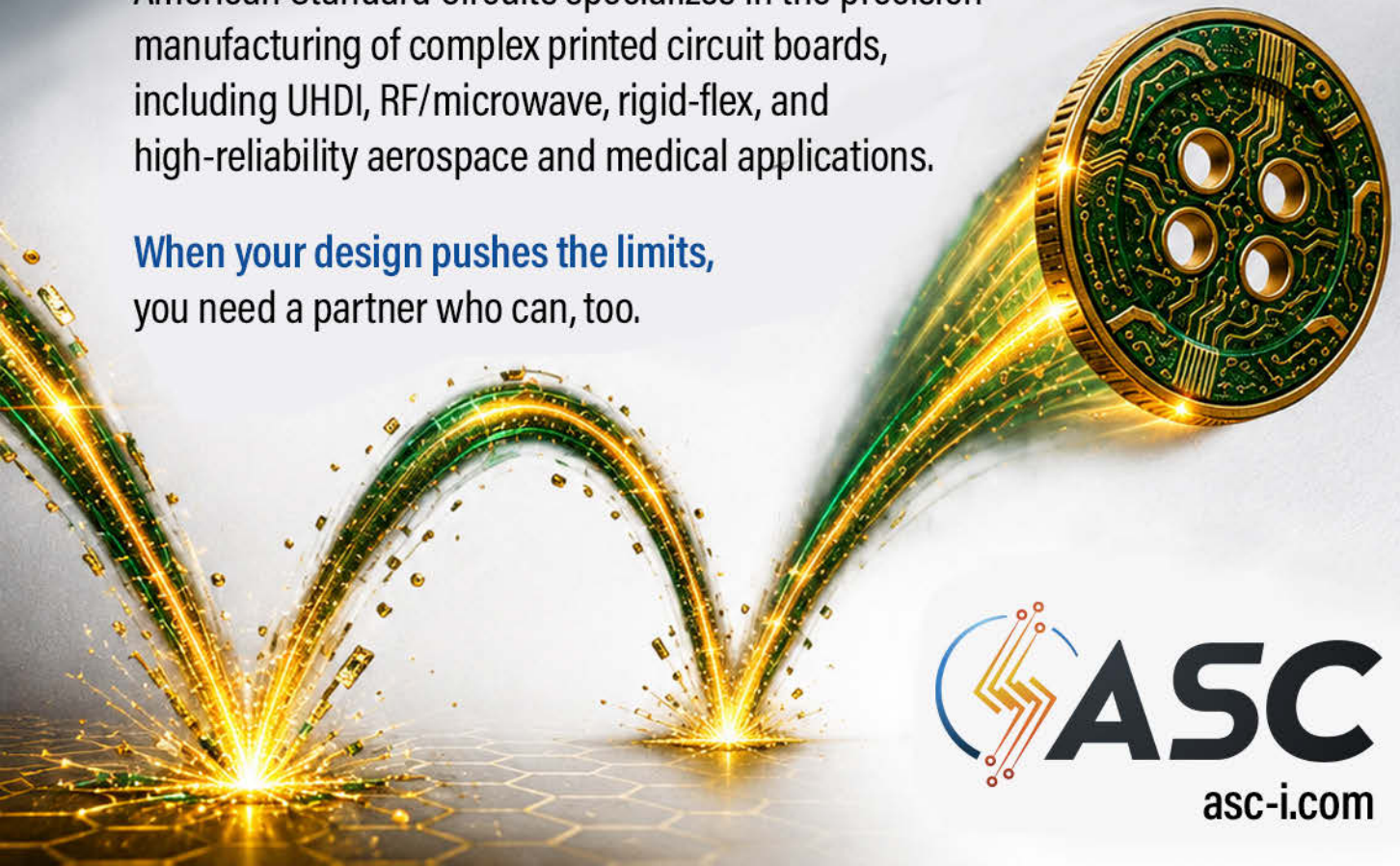
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These effects may occur at radiation levels much lower than those required to cause visible physical damage. They can also be random, meaning that exceeding a threshold does not guarantee that an individual device will fail. Instead, the probability of a failure occurring somewhere within a production lot may increase.

Radiation dosage is cumulative. A device inspected during initial production, after rework, during failure analysis, and again during customer-return evaluation receives exposure during each inspection cycle.

Typical Radiation Thresholds

Not all commercial-off-the-shelf semiconductor devices have the same sensitivity to radiation. In fact, most devices will not be affected by the levels normally experienced during routine X-ray inspection. However, maximum radiation values published by semiconductor manufacturers can vary widely, and the dose at which a random event may occur can be difficult to define precisely.

These ranges should be treated as general reference values rather than universal acceptance limits. Device-specific information provided by the semiconductor manufacturer should take precedence

whenever it is available.

Because radiation-related effects can be random, exceeding an approximate threshold does not mean that every semiconductor device will fail. It may instead increase the statistical probability of failure within a larger production population.

Oblique Angle Viewing

Oblique-angle viewing is an important capability of X-ray inspection systems, particularly when evaluating BGAs, CSPs, and other area-array devices. In a direct top-down image, the body of the solder ball can obscure the interface between the ball, component termination, and PCB pad.

Some older X-ray systems create an angled view by tilting the sample. Tilting generally requires moving the sample farther from the X-ray tube focal point, which reduces the available magnification.

As package and solder-joint dimensions continue to decrease, higher magnification becomes important. For this reason, many modern systems maintain the sample perpendicular to the X-ray focal point and instead create oblique views by moving the detector.

Moving the detector preserves magnification and analytical detail. However, because the

Table 2: Approximate radiation-damage threshold ranges for selected commercial semiconductor devices

Device Type	Threshold (rads)	Threshold (Gy)
Linear	2,000–50,000	20–500
Mixed Signal	2,000–30,000	20–300
Flash Memory	5,000–15,000	50–150
DRAM	15,000–50,000	150–500
Microprocessors	15,000–70,000	150–700

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sample remains close to the X-ray source, the device does not receive the dose-rate reduction that would result from increasing its distance from the focal point. Dose estimates should therefore account for the actual sample position during oblique inspection.

Minimizing Radiation Dosage

A semiconductor device receives some radiation throughout the X-ray inspection sequence. However, the greatest portion of the total dose is typically received while the device is positioned close to the X-ray source for high-magnification inspection.

Practical methods for reducing radiation dose include:

- Increase the distance between the sample and the X-ray tube focal point whenever maximum magnification is unnecessary
- Inspect only the areas requiring examination
- Limit extended exposure over radiation-sensitive components
- Minimize inspection time through standardized or automated inspection routines
- Avoid unnecessary repeated inspection following rework or repair
- Track the number of inspection cycles performed on sensitive assemblies
- Measure actual dose using a chemiluminescent dosimeter when component sensitivity is a concern
- Evaluate appropriate X-ray filtration for the specific equipment and inspection requirement

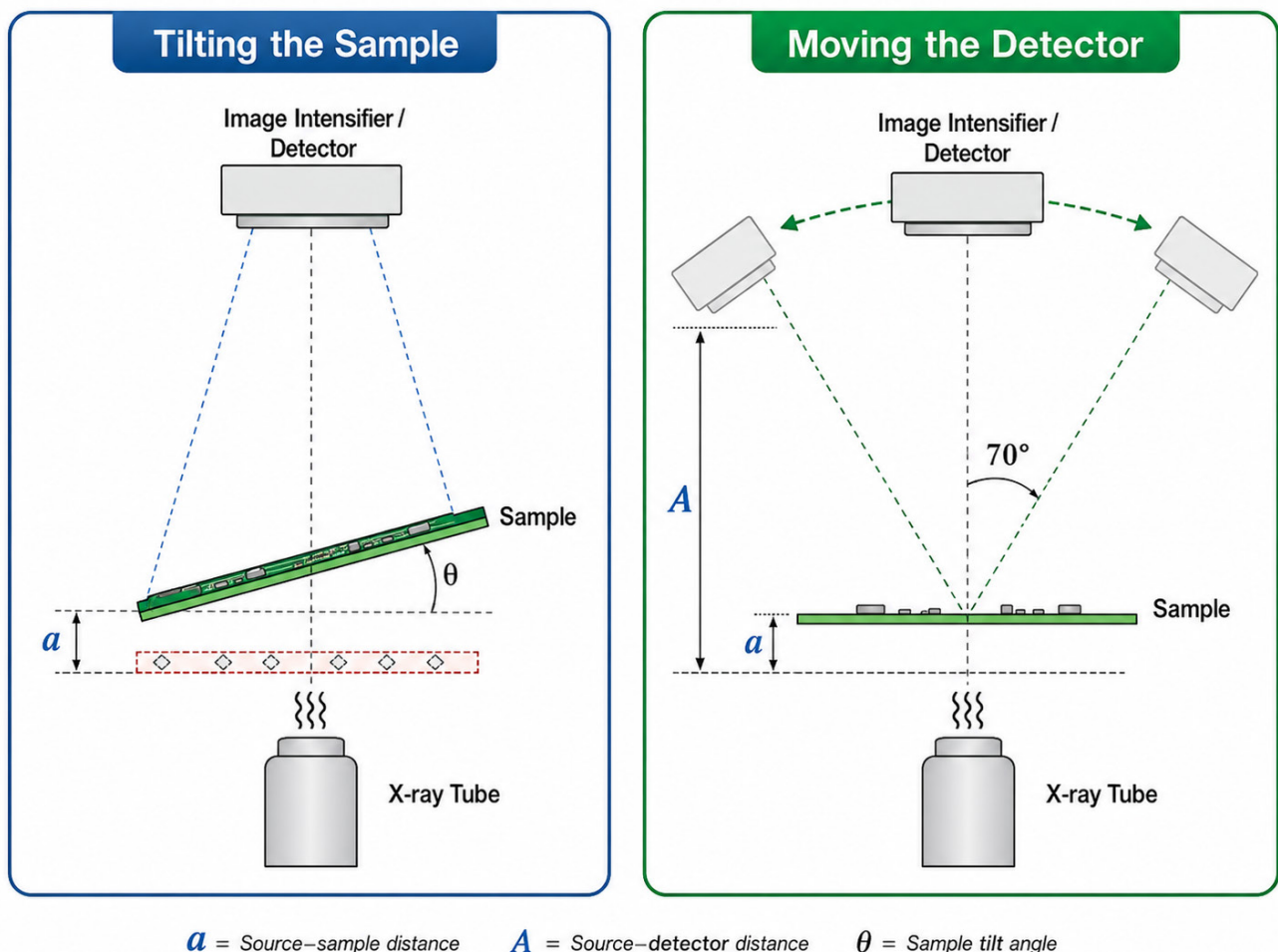


Figure 2: Comparison of tilting the sample and moving the detector to obtain an oblique-angle view.

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Table 3: Effect of focal-point-to-sample distance on radiation dose rate

Distance (mm)	Dose Rate (rads/min.)	Dose Rate (Gy/min.)	Time to 100 Rads (min.)
2.0	100.0	1.000	1.0
3.1	41.6	0.416	2.4
4.4	20.7	0.207	4.8
6.9	8.4	0.084	11.9
11.1	3.3	0.033	30.3
17.5	1.3	0.013	76.9
31.4	0.4	0.004	246.0

Filtration can reduce lower-energy radiation that contributes to device dose without always providing a proportional improvement in image quality. However, the effectiveness of a filter depends on the X-ray system, tube settings, detector sensitivity, sample construction, and required image detail. Any filtration method should be validated before being incorporated into a production inspection process.

The distance between the sample and the X-ray source remains one of the most important factors affecting dose rate. Increasing the focal-point-to-sample distance reduces radiation exposure according to the inverse-square law, although it also reduces magnification.

For example, increasing the focal-point distance from approximately 2.0 mm to 6.9 mm can reduce the dose rate by approximately 90%, while still providing sufficient image detail for many routine inspection tasks.

The objective should not be to use the lowest possible X-ray settings at the expense of inspection quality. Instead, the goal is to obtain the necessary image quality to make a reliable inspection decision while avoiding unnecessary magnification, power, exposure time, and repeated inspection.

Conclusion

X-ray inspection remains an essential and generally safe method for evaluating hidden solder joints and internal features within printed circuit board assemblies. However, assemblies containing radiation-sensitive semiconductor devices or requiring repeated high-magnification inspection may need additional dose controls.

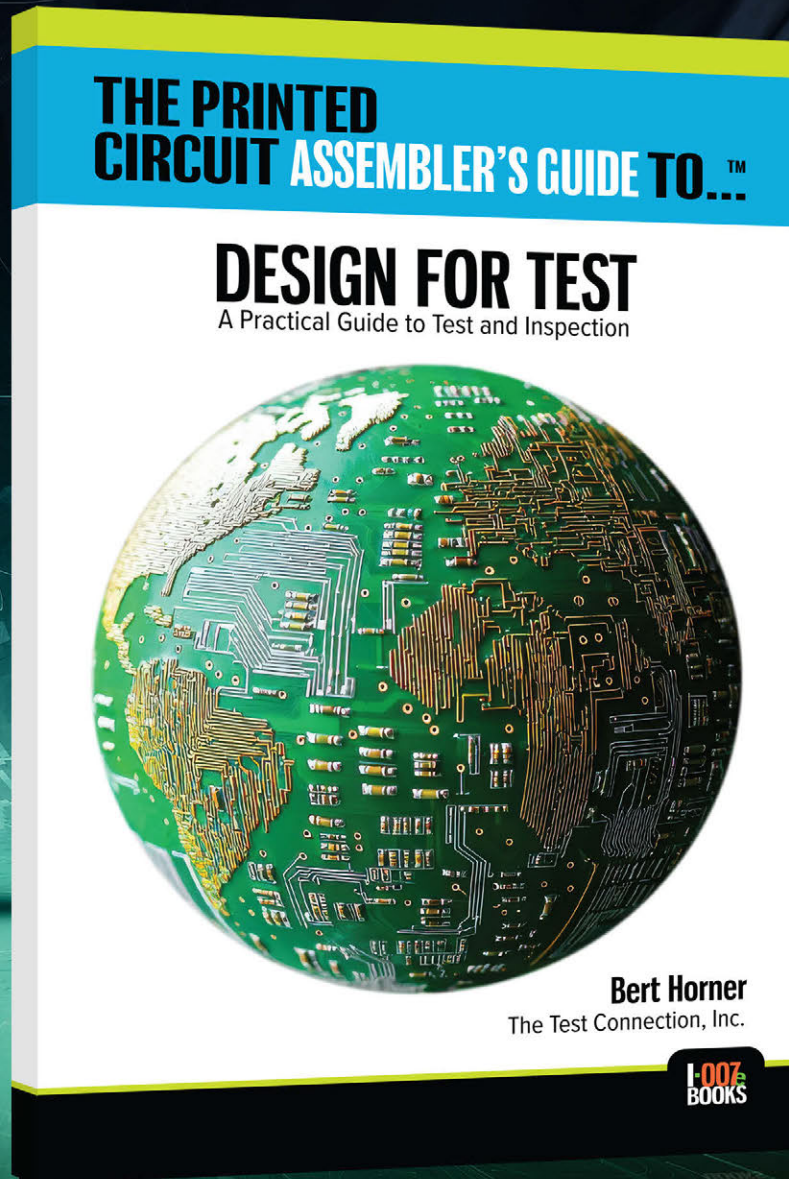
Users should understand how source-to-sample distance, tube settings, exposure time, filtration, and repeated inspection cycles affect the total radiation dose delivered to the assembly. When a device is known or suspected to be radiation-sensitive, the proposed inspection procedure should be reviewed and, when necessary, the actual dose should be measured.

A controlled inspection process allows users to obtain the analytical information needed to verify assembly quality while minimizing unnecessary radiation exposure to semiconductor devices. **SMT007**



Nash Bell is president of BEST, Inc. To read past columns, [click here](#).

The Assembler's Playbook for Modern DFT



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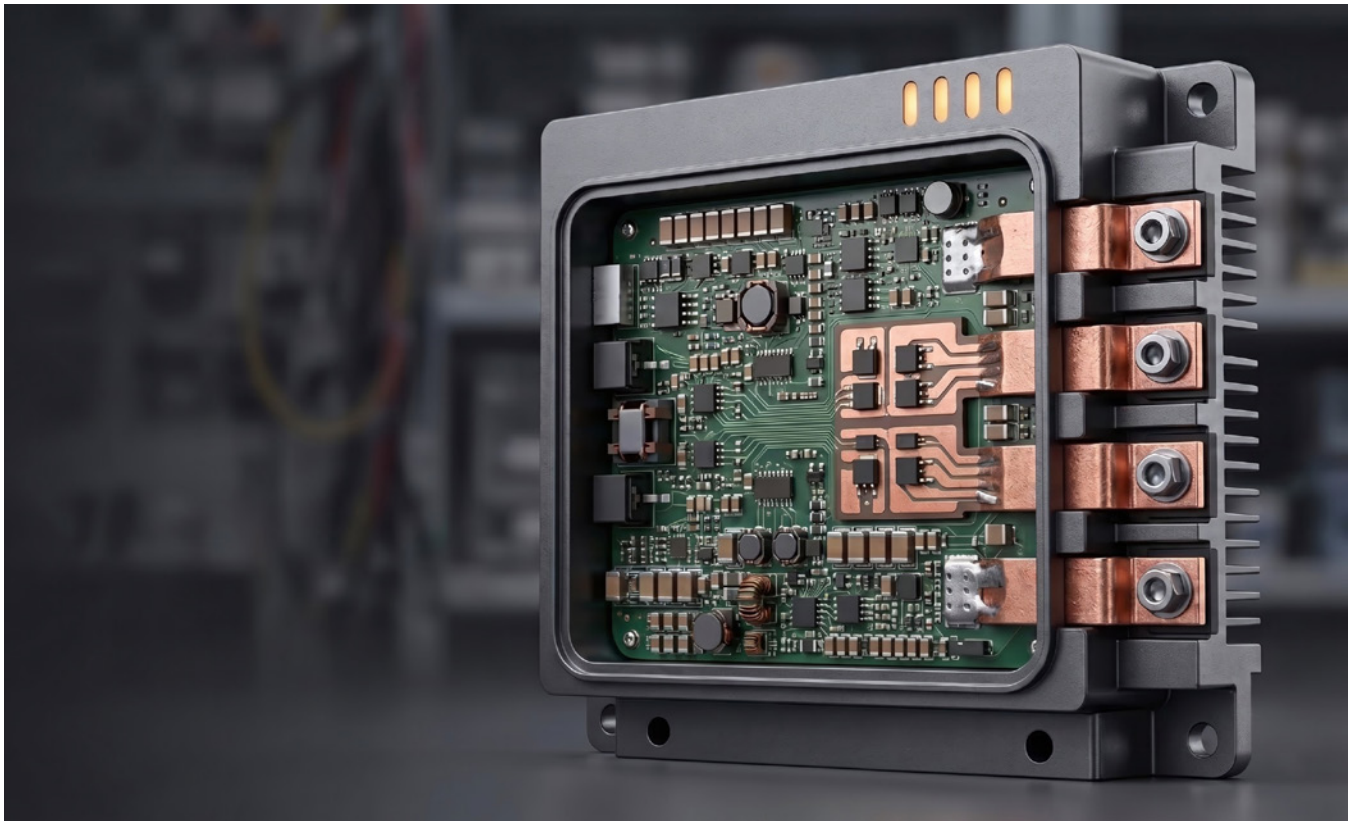
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From Substrate to System

The Power Module Assembly



BY BRIAN BUYEA, REMTEC

If you ask 10 engineers what “assembly” means in electronics, you’ll likely get 10 variations of the same answer: placing components on a board and soldering them down. That definition might work for traditional PCB-based electronics, but in high-power, high-reliability systems, it falls short by a mile.

Power module assembly is actually about building a system from the ground up, one that must handle heat, current, mechanical stress, and

time without failure. When you’re working with ceramic substrates and high-performance materials, assembly becomes less of a step and more of a discipline.

So, a power module assembly includes everything required to transform a bare substrate into a fully functioning, field-ready system—electrically, thermally, and mechanically integrated—and every step matters.



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Assembly Is More Than Placement

In ceramic-based electronics, assembly starts long before anything is physically attached. It begins with understanding how the substrate, the devices, and the final application all interact.

This is not a “drop it on and solder it” environment. You’re dealing with materials like alumina or aluminum nitride, chosen for their thermal conductivity and stability. You’re often integrating bare die instead of packaged components, and you’re designing for environments where failure is not an option: electric vehicles, aerospace systems, defense platforms, industrial drives.

Assembly, in this context, is the process of integrating electrical performance, thermal management, and mechanical integrity into one unified structure. That’s a very different mindset.

Die Attach: The Foundation of Performance

Everything starts with die attach, the process of securing the semiconductor die directly onto the substrate. It sounds simple, but it’s one of the most critical steps in the entire assembly process because the die attach layer is responsible for both electrical conduction and thermal transfer. If it’s done poorly, you create electrical and thermal resistance, which, in power electronics, is the enemy.

There are several methods used depending on the application—solder attach, sintering, conductive adhesives—but the goal is always to create a strong, uniform bond that efficiently transfers heat away from the die while maintaining electrical integrity. Think of die attach as the foundation of a building. If it’s weak or inconsistent, everything built on top of it is at risk.

Wire Bonding: Connecting Performance to Reality

Once the die is attached, it needs to be connected, and that’s where wire bonding comes in. It creates

the electrical connections between the die and the rest of the circuit. Typically using gold, aluminum, or copper wire, this process forms the pathways through which current flows.

But wire bonding isn’t just about making a connection. It’s about making the right connection. Bond geometry, loop height, wire diameter, and placement all impact performance. In high-power applications, these factors influence current handling, resistance, and even inductance. Poorly designed or executed wire bonds can become points of failure under thermal cycling or vibration.

In other words, wire bonding is where electrical design meets physical reality and gets tested.

Encapsulation: Protecting What Matters

Now that the die is attached and connected, it needs to be protected. Encapsulation is the process of sealing the assembly to protect it from environmental factors, including moisture, contaminants, mechanical damage, and thermal stress.

This step is essential in high-reliability applications because power modules do not operate in clean, controlled lab environments. They operate in vehicles, on factory floors, in the sky, and sometimes in space.



Encapsulation materials must be carefully selected to match the thermal expansion properties of the substrate and components. If they don't, you introduce stress, and that leads to cracks, delamination, and eventual failure. Done correctly, encapsulation extends the life of the module and ensures consistent performance over time.

Housing Integration: Where Mechanics Meets Electronics

At some point, the assembly needs to become a product, and that's where housing integration comes in. This involves incorporating the assembled substrate and components into a mechanical structure that supports the module, protects it, and often contributes to thermal management. It's part of the system that must account for mounting requirements, vibration, thermal expansion, and heat dissipation. In many cases, it includes features like heat sinks, baseplates, or direct cooling interfaces.

Problems arise when housing is designed in isolation from the electronics. Misalignment, stress points, and thermal inefficiencies become common. But when housing is integrated into the assembly process from the beginning, everything fits, mechanically and functionally.

Why Integration Reduces Failure Points

Now, let's shift from process to strategy. When power module assembly is handled by multiple vendors—one for substrates, another for die attach, another for packaging—you introduce interfaces, and every interface is a potential failure point. You get miscommunication, material mismatches, and process inconsistencies.

Integrated sourcing, where one partner manages the entire assembly process, eliminates those gaps. It ensures that every step is aligned, every material is compatible, and every process is optimized for the final application.

Thermal Performance: The Real Battleground

Heat drives the evolution of power module assembly. As power densities increase and devices get smaller, the demand for efficiency is relentless. In this environment, thermal performance is everything.

A unified assembly approach allows for optimized heat flow from the die, through the attach material, into the substrate, and out through the housing. Every layer is designed to work together. Ceramic substrates already offer a significant advantage due to their high thermal conductivity, but that advantage can be lost if the assembly process isn't properly aligned. When it is aligned, you get systems that run cooler, last longer, and perform more reliably.

Lifecycle Support: From Design to Production

Power module assembly doesn't end when the product is built. In many ways, that's just the beginning. True assembly capability includes lifecycle support, from design collaboration through prototyping to production.

Early design involvement allows engineers to optimize layouts, select the right materials, and anticipate challenges before they become problems. Prototyping validates those decisions, which ensures consistency at scale.

This continuity is critical because in high-performance electronics, small changes can have big consequences. Having a single partner involved from start to finish ensures that knowledge is retained, lessons are applied, and performance is maintained.

The Bottom Line

So, what is included in power module assembly? It's die attach, wire bonding, encapsulation, and housing integration, but more importantly, it's the integration of all those elements into a single, cohesive system and the understanding that performance is determined by how well every step works together.

As power electronics push the limits of what's possible, you need that level of integration. Powering the future is about building systems that work no matter what. **I-CONNECT007**



Brian Buyea is president of Remtec Inc. To read past columns, [click here](#).

PREPARING FOR A New Laminate Supply Reality



The global laminate industry has entered a period of structural change unlike anything seen in recent decades. Explosive investment in AI infrastructure, including AI servers, advanced networking, optical communications, and data centers, is driving demand for laminate materials at a pace the supply chain cannot match.

The warning signs have been building for months. Extended lead times, repeated price increases, customer stockpiling, raw material allocation, and major capacity expansion announcements all

point to an industry increasingly under strain. How prepared are individual companies to respond to these changes?

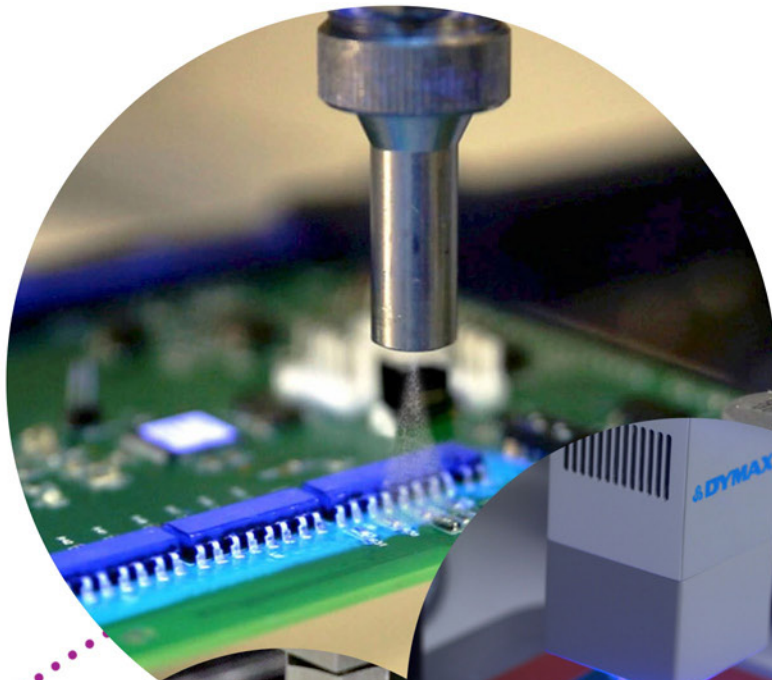
Experience from previous supply chain disruptions has shown that resilience cannot be created once a crisis begins. Alternative materials, qualified suppliers, strategic inventory, and long-term partnerships all require time to establish.

Compounding today's challenge are less visible pressures that extend beyond material shortages. As production capacity shifts toward higher-value



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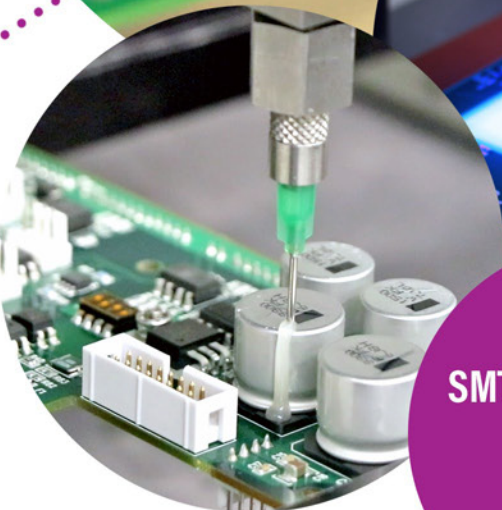


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AI applications, we see secondary constraints in conventional PCB materials. Rising inventory values are placing unprecedented demands on working capital throughout the supply chain.

For example, major vertically integrated groups such as Kingboard Holdings and Nan Ya Plastics Corporation are reducing merchant sales of glass yarns and fabrics in favour of internal consumption. They operate extensive downstream prepreg, copper-clad laminates (CCL), and PCB manufacturing businesses, and given their scale and reach across the value chain, these groups can shape pricing dynamics throughout the broader PCB industry. The consequence is less material reaching the merchant market, increased pressure on independent manufacturers, and a further acceleration of allocation-driven supply conditions.

So, for many organizations, the greatest competitive advantage over the coming months may not be simply securing material, but having the financial resilience and supply chain strategy to secure it before constraints become critical.

Key Industry Developments

1. AI Demand Is Reshaping the Entire Electronics Materials Supply Chain

The rapid deployment of AI servers and supporting infrastructure extends well beyond semiconductors and packaging, and is driving substantial increases in consumption of CCLs, prepregs, copper foils, glass yarn and glass fabric, and high-performance resin systems. Industry analysts view AI infrastructure as the dominant demand driver across the PCB and laminate sectors for the remainder of the decade.

2. Lead Times Continue to Extend

Industry reports indicate significant increases in lead times for laminate materials, up to 140 days for advanced laminate grades, and beyond historic norms for FR-4 products. PCB manufacturers are placing unusually large forward orders to increase inventory holdings, indicating a shift toward allocation-based supply management and a higher priority than short-term price optimisation.

3. Capacity Expansion Is Underway Across the Industry

Major laminate manufacturers throughout Asia have announced significant investment programmes designed to expand prepreg and laminate capacity. However, industry participants report long lead times for new laminating equipment, and 18–24 months for capacity expansion projects to become fully operational.

4. Upstream Raw Materials Remain the Primary Constraint

The most significant risks are concentrated upstream. Industry reports consistently identify shortages and allocation measures affecting glass yarn, glass fabric, very low profile (VLP) and hyper very low profile (HVLP) copper foils, specialty resin systems, and certain chemical intermediates.

These constraints directly impact prepreg and laminate production regardless of downstream manufacturing capacity. Consequently, the industry's ability to increase output is becoming increasingly dependent on the expansion of raw material supply rather than on laminate manufacturing capacity alone.

The Hidden Working Capital Challenge

As demand shifts toward premium laminate systems, advanced resin technologies, and HVLP/VLP copper foils, companies face a double financial burden. Not only are they being forced to carry higher inventory levels to mitigate supply risk and secure allocation, but the value of every square metre of inventory is increasing significantly.

This combination means working capital requirements can rise substantially faster than revenue growth. Inventory that previously represented weeks or months of supply may now tie up as much as four times the capital. The result is additional pressure on the balance sheets of distributors, PCB manufacturers, CCL producers, and OEMs alike. For many organisations, access to material may not be the only constraint and could become an equally important competitive differentiator.

In these situations, financial risk also increases, so greater vigilance over debtor exposure, credit



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management, and cash flow becomes essential. Organisations that have historically relied on extended payment terms or loosely managed working capital may be difficult to sustain. It is reasonable to expect tighter payment terms, reduced credit availability, and growing pressure to unwind vendor-managed inventory arrangements as suppliers seek to protect liquidity and reduce balance sheet risk.

Rather than material availability, the first signs of disruption may appear in the amount of cash required to secure future supply. Companies with stronger balance sheets, earlier commitments, and closer supplier relationships are likely to gain a significant advantage.

The reallocation of capacity toward higher-growth and higher-value market segments has led to a series of secondary constraints. These effects are often less visible but may ultimately have a broader impact across the PCB supply chain.

How Manufacturers Can Allocate Scarce Materials

As AI infrastructure drives demand for premium materials, laminate suppliers are directing investment, engineering resources, and production capacity toward higher-margin products. The result is that conventional materials can become more difficult to source even as overall industry capacity expands.

Glass Reinforcement

Glass manufacturers are accelerating investment in advanced low-CTE and low loss materials such as T-glass and LK Glass, often using manufacturing assets that would otherwise support conventional E-glass production.

As a result, the industry is seeing:

- No investment in conventional E-glass capacity in Japan and Taiwan
- Growing dependence on Chinese suppliers for new capacity
- Conversion of production resources toward higher-value glass products
- Longer lead times for standard glass yarn and fabric constructions
- Reduced availability of heavier-weight glass styles used in traditional FR-4 laminates

The proportion of glass yarn and fabric available through traditional merchant channels is declining as vertically integrated groups reserve production for internal consumption. This reduces the industry's ability to balance supply through open-market transactions and increases its dependence on a smaller number of integrated supply chains.

Copper Foil and Resin Systems

The same pattern is emerging in copper foil and resin systems. Investment is increasingly focused on VLP/HVLP copper foils and advanced low loss resin systems that support AI, high-speed networking, optical modules, and advanced computing applications. While this expands capacity for premium products, it places pressure on conventional HTE and RTF foils and standard FR-4 systems, which remain essential in PCB manufacturing.

The conflict with Iran adds further uncertainty and risk to an already constrained laminate supply chain. Disruption to energy, petrochemical, and logistics markets puts cost pressure on epoxy resin feedstocks, while separate disruption to bromine and TBBPA flame-retardant supply chains risks further inflation in FR-4 production costs.

Laminate Manufacturer Prioritisation

When glass fabric, copper foil, or resin systems are constrained, manufacturers naturally seek to maximize output, revenue, and contribution from the limited resources available. Historically, shortages have often resulted in the prioritisation of the highest revenue contribution per unit of constrained raw material consumed.

This is particularly relevant in glass fabric shortages. A fixed quantity of glass fabric can typically generate significantly more square metres of thin laminate or prepreg than thick laminate products. Manufacturers, therefore, have a strong economic incentive to allocate constrained materials toward products that maximize throughput, revenue, and profitability.

This allocation behaviour illustrates why current market conditions appear less like a conventional cyclical upswing and more like a structural supply chain realignment. Even with new capacity, the demand for AI infrastructure and continued upstream constraints is likely to keep supply-demand imbalances in place for years.

Several indicators support this assessment:

- Multiple rounds of price increases across the supply chain
- Extended lead times for both standard and advanced materials
- Significant stockpiling activity across the supply chain
- Major capital investment programmes by laminate manufacturers and upstream raw materials producers
- Continued reports of raw material shortages and allocation enforcement
- Ongoing acceleration of AI-driven demand

Even with additional capacity throughout the supply chain, demand growth appears to be outpacing the industry's ability to respond.

Preparing for a Prolonged Supply Constraint

The key challenge is shifting from price management to supply assurance. Transactional purchasing models, short forecast horizons, and single-source material strategies are becoming riskier as availability replaces price as the industry's primary constraint. Companies that secure allocation, maintain material optionality, and engage proactively with suppliers will be better positioned than those relying solely on price-driven procurement strategies.

Organisations should consider:

- Longer-term forecasting and demand visibility
- Earlier purchasing commitments
- Qualification of alternative materials and suppliers
- Strategic supplier partnerships
- Design-for-availability principles during product development
- Ensure sufficient working capital to support higher inventory values and longer procurement cycles



The key challenge is shifting from price management to supply assurance."

The warning signs have been visible for months, but we are likely to enter the most challenging phase in the coming months of 2026, and which will likely persist into 2028. Don't wait. Resilience programmes, material qualifications, and alternative supply chains require time to implement, and options are diminishing rapidly. Those waiting for shortages to become apparent in their own operations may discover that the market has already moved beyond the point at which effective mitigation is possible. **I-CONNECT007**

Resources and Further Reading

Industry Supply Chain and Lead Time Reports

- "AI Demand Tightens CCL Supply, Drives Advance Orders, Price Hikes, and Expansion," TrendForce, May 5, 2026.
- "Global Shortage of Glass Fiber Cloth Continues," by Raymond Goh, CONFIDEE, March 4, 2026.
- "How OEMs Can Navigate AI-Driven PCB and CCL Supply Constraints," Vexos.
- **Market and Capacity Expansion Information:** EMC Investor Relations
- "Laminate Industry Capacity Expansion Reporting," DigiTimes.
- **Industry Associations and Market Data:** Taiwan Printed Circuit Association and Global Electronics Association.



Mark Goodwin is chief operating officer, EMEA & USA, Ventec International Group.

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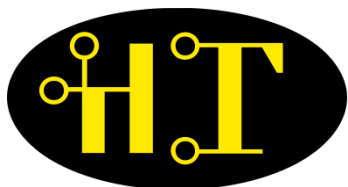
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Keith Furr, Commercial Director, at
Keith.furr@macdermidalpha.com.

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