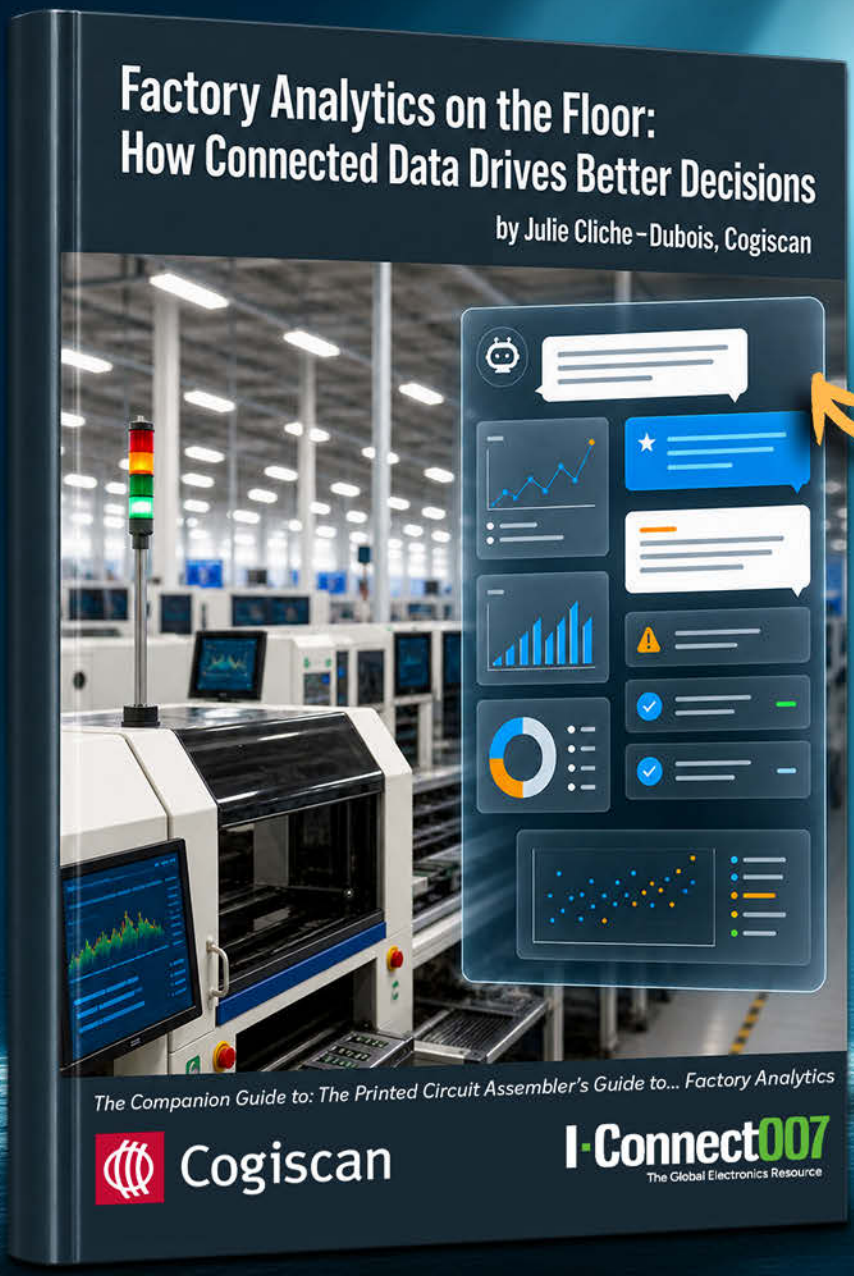
NOVEMBER 2026

SMT007 MAGAZINE

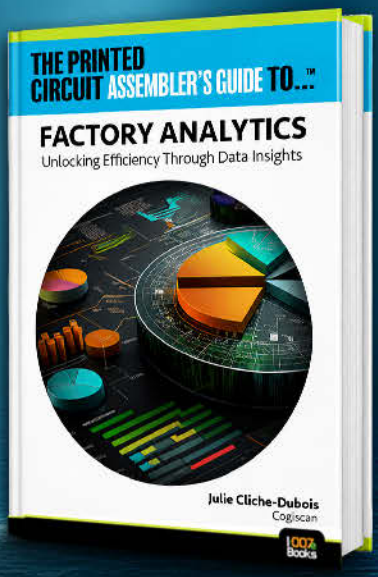


Factory Analytics on the Floor

How Connected Data Drives Better Decisions



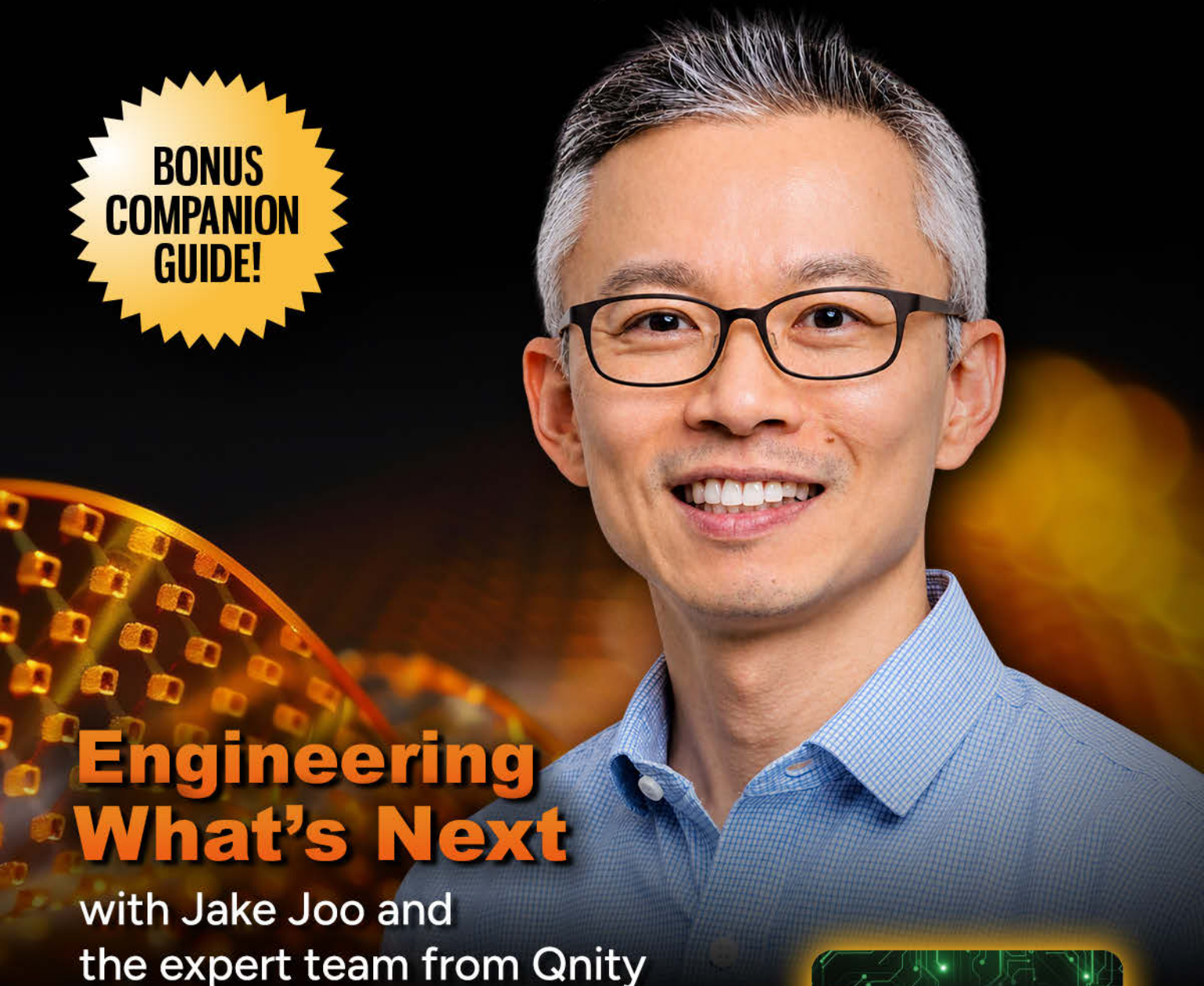
Download the companion guide to the popular book from Cogiscan.



I-007eBOOKS

PODCAST | SERIES 9

BONUS COMPANION GUIDE!



Engineering What's Next

with Jake Joo and the expert team from Qnity

Explore the science behind the next generation of electronics. In this six-part series, Qnity experts examine the innovations advancing mission-critical reliability, flexible electronics, thermal management, and sustainable design.

Listen now to discover how better materials are enabling what's next.

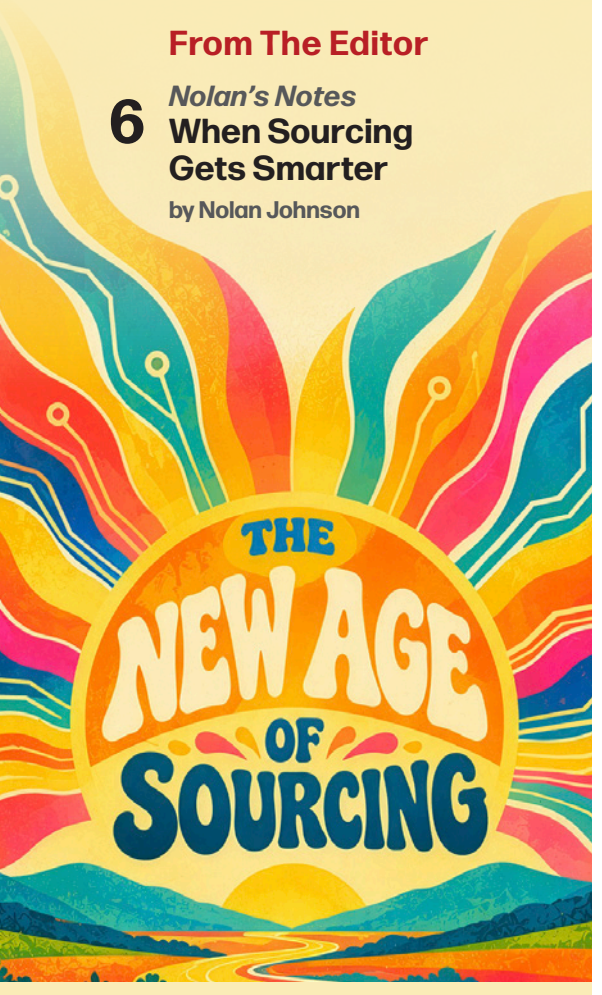
ON THE LINE WITH... I·Connect007

Listen on Apple Podcasts

Listen on Spotify

LISTEN NOW!

November 2026



The New Age of Sourcing

Sourcing has become more complex, but EMS companies have new ways to take control. This issue examines software tools for material management, cleaner and more consistent data, and the true costs of tariffs. Experts explore how better information can improve purchasing, inventory decisions, and supply chain planning.

Features

10 **Practical Material Management for High-Mix EMS**
by Scott Ryan

22 **Finding Lead Time in the Messy Middle**
by Ralph Richart

38 **The Hidden Costs of Tariff Stacking**
with Mark Zetter

50 **Taking Stock of the New Forced-Labor Tariffs**
by James Kim

Articles

56 **Designing PCBs for Heat Staking: The Hole, the Head, and the Copper Around Them**
by Alex Spurgeon

Columns

Bridging the Pacific
18 **The Universal Language of Quality**
by Tianming Liu

The Clean Truth
32 **ROSE Testing Has Its Limits**
by Dr. Adam Klett

Knocking Down the Bone Pile
44 **The Use of BGA Rework Stencils**
by Nash Bell

From The Editor

6 *Nolan's Notes*
When Sourcing Gets Smarter
by Nolan Johnson

Shorts

43 *The Printed Circuit Assembler's Guide to... Design for Test: A Practical Guide to Test and Inspection*
by Bert Horner

In Every Issue

30 MilAero007 Highlights
65 Career Opportunities
72 Educational Resources
73 Advertiser Index

SMT007 MAGAZINE

CREATE YOUR Connections

THERMAL SYSTEMS



Technica USA & Rehm Thermal Systems Connect to Elevate Customer Support for Electronics Manufacturing

TECHNICA, U.S.A.

1-800-909-8697 · www.technica.com

CELEBRATING 40 YEARS



When Sourcing Gets SMARTER

BY NOLAN JOHNSON, I-CONNECT007

"It's a New Age" is such a cliché, I roll my eyes whenever I hear it. In the 1969 musical "Hair," they sang about "the Age of Aquarius," a time that would bring peace, love, harmony, and understanding. While an "age" is an indefinite unit of measurement, these free-spirited hippies were referring to an astrological cycle, which lasts about 2,160 years (although its exact start is open to interpretation). Geologically speaking, an age spans 2 to 10 million years. That is, in fact, a very long time. This all just illustrates why, when that phrase gets dropped into a conversation, my proverbial cynical eyebrow gets raised.

So, should we be leaning on this familiar trope of a "new age" to describe the current state of sourcing? Surely we can't believe it will hold up to an astrological age of 2,000+ years. No, in this case, we use the phrase to capture the feeling of a fundamental and irreversible sea change in sourcing, specifically in how EMS companies take greater control of their sourcing efforts.

We've all lived through this supply chain saga for the past eight years or so (some will argue it's been even longer), but the tools and systems we've used

CETEC ERP

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/

to manage sourcing haven't really changed—I'm looking at you, Microsoft Excel. Until now, that is.

Software developers are leveraging more online information from suppliers, government agencies, and OEM design teams to make innovative strides in automating vendor scheduling, component availability, and pricing. New tools have emerged over the past five years to improve in-house inventory management and to help make part ordering smarter and more cost-effective. The recent trade negotiations and rapidly fluctuating tariff rates have spurred the development of tools that give buyers a complete picture of tariff costs across each channel, sometimes uncovering hidden costs in the supply chain. The days of running receiving and stock room from an Excel spreadsheet are over, or at least they can be. So, yes. We are entering a new age in sourcing, and it's one in which the EMS company has access to tools that provide greater insight and control.

In this issue, we focus on in-house software tools that make full use of this new environment. A common theme running through all the feature content is "data normalization." To get the most out of the available data, all the apples need to be converted to oranges, so to speak. To that end, we bring you an article by Scott Ryan at Cetec discussing the practicalities of material management. Ralph Richart from MetisLogic educates us on the impact of, and the solution to, the "messy middle," and Mark Zetter details how his product enables decision-making clarity amid the complexity of tariff stack analysis, thereby empowering purchasers and planners.

Our cavalcade of columnists brings their expertise to the issue as well. Nash Bell knocks down the bone pile with BGA stencil best practices, Adam Klett clears up the role and value of ROSE testing, and "The Universal Language of Quality" is on Tianming Liu's mind this month.

Finally, Alex Spurgeon of U.S. Heatstake gives readers a comprehensive technical piece exploring the fundamentals of heat staking and its ideal applications in electronics assembly.

Just like the magician's trick of pulling a scarf out of their fist, only to have it turn into a long line of scarves tied together, the tariff articles from Zetter and Kim, when taken together, open an area of discussion deserving of an entire issue. **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.





STRONG PARTNERSHIPS GROW LONG BEFORE THEY'RE NEEDED.

Material shortages.
Longer lead times.
Supply chain uncertainty.

These challenges are affecting much of the PCB industry. Preparation makes the difference.

At FSQuality, decades of strategic supplier relationships and global sourcing strength help ensure reliable access to critical materials — keeping your production moving when others slow down.

When the market gets tough, the right partner stands out.







FSQuality
First Quality Circuit Co., Ltd.

GLOBAL STRENGTH
Local Support

ON-TIME DELIVERY
When It Matters

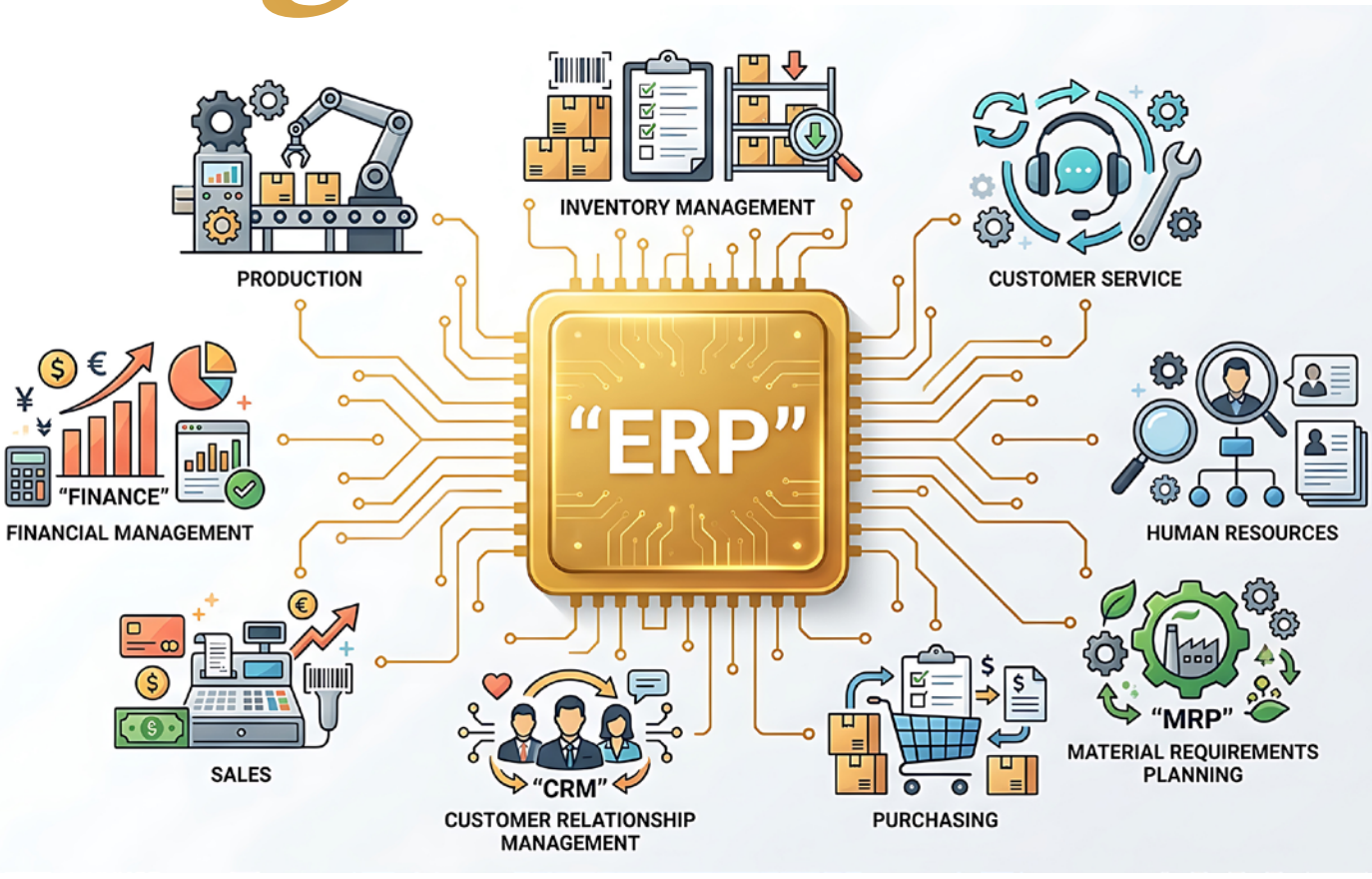
TRUSTED QUALITY
Every Step

YOUR SUCCESS
Is Our Priority

www.fqc.co.th

BY SCOTT RYAN, CETEC

Practical Material Management for High-Mix EMS



High-mix EMS companies take on their customers' chaos and supply chain volatility. Every customer that sends a BOM expects to be handled as if they were the only customer in the building. Inventory must often be tracked by customer, PO, or program to satisfy contractual, quality, and traceability requirements. Yet dozens of BOMs, each with hundreds of components across multiple assembly levels, can share manufacturer part numbers and SMT lines, and few jobs follow the standard order-to-shipment path. Treating every job as an island multiplies purchasing and material handling costs. Profitable growth requires simplifying shared physical inventory while preserving each customer's discrete records.

How can a small or mid-sized EMS company punch above its weight, supporting each customer with the detail a larger company would provide, while keeping inventory and supply chain costs under control?

The answer starts with approved component modeling, consolidated planning and purchasing, and family kitting. A full-suite manufacturing ERP connects these processes to production scheduling, procurement, quality, traceability, and accounting. That integration gives smaller companies a practical way to scale.

Stop Paying for Silver YOU DON'T NEED

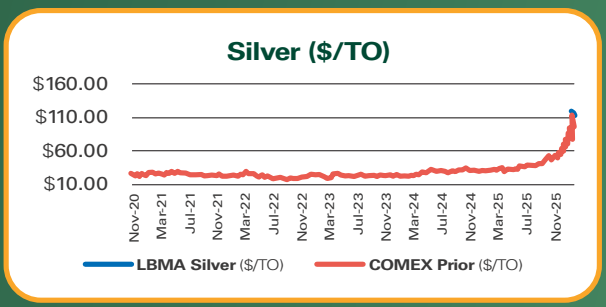


LOW-SILVER SOLDER ALTERNATIVES

- **Indium Corporation advanced flux technology enables reliable soldering performance with low-silver alloys**
- **Many applications don't need the thermal cycling reliability of SAC305**
- **Low silver offers substantial cost savings—up to $50–65 per kilogram!**

Low-Silver Solder Alloys for Solder Paste or Cored Wire:

- Indalloy®302
- Indalloy®291
- SAC0307
- SAC105



Contact us today to reduce your soldering costs without sacrificing quality:

indium.com

From One Engineer To Another®

©2026 Indium Corporation

INDIUM® CORPORATION®

Part Numbering Schemes: Small Choices With Large Outcomes

Each BOM is unique to the customer and must be modeled one-to-one in the contract manufacturer's system. In EMS, that includes approved alternates for the customer's design: functionally identical components differentiated by manufacturer or packaging.

Modeling raw components by manufacturer part number (MPN) usually provides the most flexibility. The temptation is to use customer-specific or internal numbers so material purchased for a job "sticks" to that demand. Further, alternate parts can also be received under the same number, providing a rough solution for functionally identical alternate parts. However, linking inventory to a single BOM means material can sit idle on one job while another build is short of the same part. MPN-based inventory reveals common demand for customers, supporting larger, more cost-effective purchases.

That flexibility requires two controls: tracking valid alternates for each BOM position and reserving material for a specific customer or job. These controls are difficult enough that many EMS companies fall back on customer part numbers. However, solutions are available for companies with sufficiently developed processes.

Modeling Components: Tracking Alternate Parts Across Shared Inventory

Tracking valid alternates requires a defined group of approved MPNs for each BOM component. These groups need to be flexible enough to be specific to a customer or BOM, yet selectively reusable to reduce maintenance.

Cetec ERP's Part Spec Groups provide that structure. Each BOM position links to a group of approved MPNs, named with the customer part number or an internal part number (IPN). This preserves the

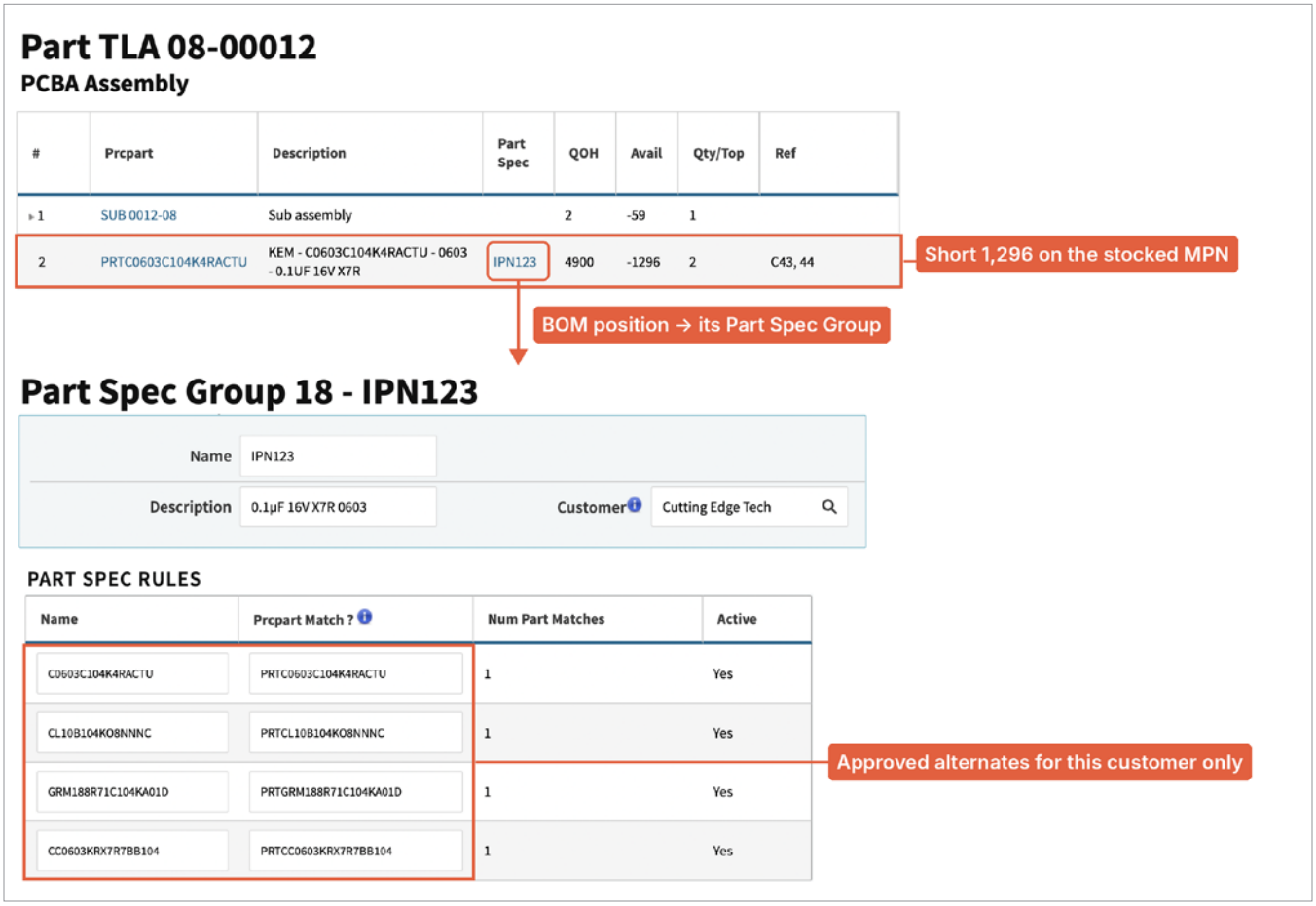


Figure 1: A BOM line linked to its approved parts management capabilities. The line is short on its stocked MPN, and the group holds the approved alternates for that customer's position.

customer's BOM and MES or machine integrations keyed to those numbers. Inventory is purchased and stocked by MPN; purchasing selects approved options against combined demand. The approved list follows the work order, so the warehouse can substitute an approved part in real time when a shortage occurs.

The receipt of the alternate used is recorded against the job, preserving part and lot traceability. Engineering reviews only new substitutions.

"We used the system like a hidden internal part number," says Matt Miers, general manager at S&Y Industries. "We still get our manufacturer part number, but we can keep track of: Customer A says you can use parts A and B; Customer B says you can use parts B and C, but don't ever use A. With all these orders coming in, we need to know which demand we can consolidate, how to get the best pricing, and when to get the parts in here.

The management tool also supports IPNs through a modeling tool listing each IPN's approved MPNs. Although MPN inventory offers purchasing advantages, changing a part numbering scheme is a mountainous task. Staff who have worked from internal numbers for years share a common language around them, a valid reason to preserve continuity.

Material Planning: Reserving Material and Protecting Commitments

Buying per job multiplies minimum-order overages and leaves material needed elsewhere stranded, hurting profit and cash. Before S&Y Industries switched systems, Miers recalls, "We were ordering work order to work order. It was a nightmare."

ERP should consolidate and time-phase demand to production. MRP nets each component's combined demand against on-hand inventory, open POs, and lead times, using work order start dates as material need dates. Purchasing sees one requirement per component, driven by the orders. Moving a job on the production schedule updates its material need date, subsequently rippling through to purchasing's MRP and shortage reports.

Two practices make consolidation work:

- **Attrition:** Include expected scrap and SMT attrition so an apparently sufficient purchase does not leave the last kit short.
- **Pre-allocation:** Reserve inventory in a bin or on a PO for a customer or order. It remains visible on hand but can be allocated and picked only for that customer's orders or the designated job, protecting customer, PO, or program commitments while sharing other inventory.

Consigned material follows the same approach: Receive it into a bin pre-allocated to a customer or job, often at no cost. Flag customer-supplied components on the BOM or order so MRP shows them to buyers. This prevents overbuying and prompts communication with the customer when supplies run low.

Reliable dates are essential. "If a date is not acknowledged, it means it's not a good date," says Betsy Cunnane, strategic initiatives manager at Solutions Manufacturing. "The date is meaningless until the vendor confirms." When a vendor pushes a delivery date, how quickly can planners identify work orders at risk and those covered by inventory purchased for other jobs? When a customer cancels a PO, how quickly can buyers identify supplier POs to cancel? This is critical risk management.

Family Kitting: Pick Together, Account Separately

Family kitting reduces handling and SMT changeovers when several assemblies share components. Handling shared material once for a combined run saves work otherwise repeated for every job.

Each job still needs separate allocations, traceability, and costs, which often pushes family kitting into a spreadsheet outside ERP.

Cetec ERP handles family kitting with batch orders and batch bin moves:

1. **Schedule the family together:** A family kit assumes the jobs start together. Give work orders a common start date so their demand falls in one need window, producing a combined purchasing requirement.
2. **Create the batch:** On the Release Build Orders screen, create a "batch," release it to material staging, and print travelers in one step.

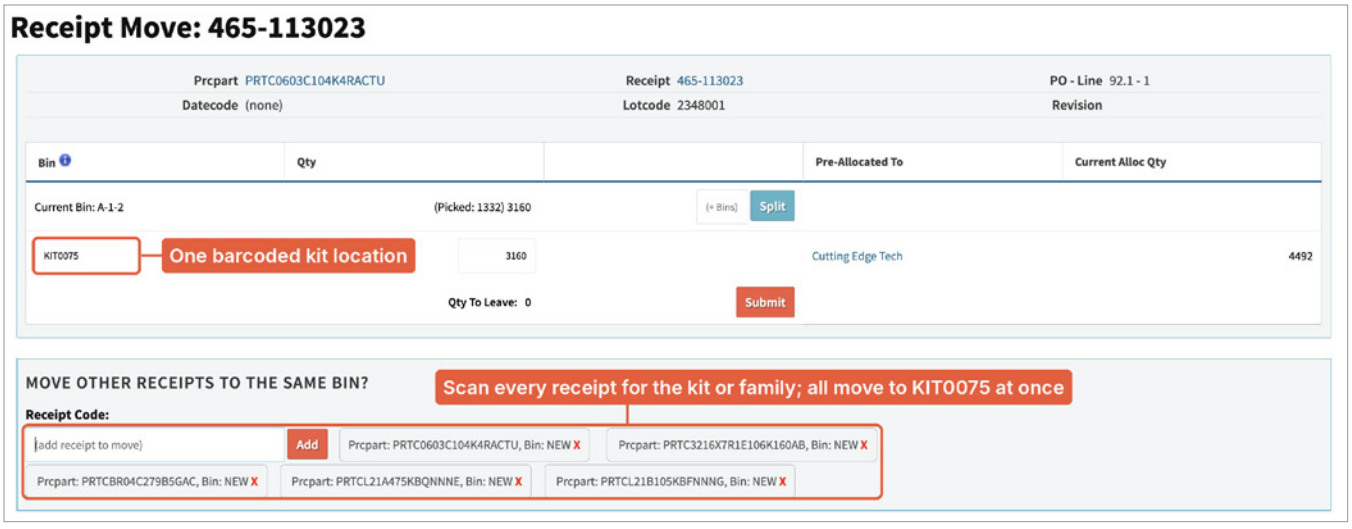


Figure 2: Receipts move to a kit location. Receipts for every part and lot in a kit, or a family of kits, are scanned to one barcoded location in a single step.

3. **Kit from a consolidated pick list:** The batch combines each component's family demand into one pick list. Kitters pull material once, and SMT uses the same list to plan feeder setups.

4. **Kit to a single location:** Working from the consolidated pick list, the kitter scans each part and lot receipt into one barcoded location named for the kit or family. Even across multiple totes, every reel can be found by scanning that location. Material is staged, not yet picked into production or WIP.

5. **Pick when production starts:** Pick per job for exact receipt-to-order traceability, or across the batch for speed and inventory quantity accuracy. Allocations and costs stay at the work order level.

6. **Return the remainder:** Once the run is complete, partial reels are returned to the warehouse with a bin move.

The kitting step grew out of a customer's request. "We didn't want to go back to running two systems, one for counts and another for locations," says Al Hadgu, Morgan Newton. "But our bigger orders go out in more than one tote, and we were digging through every tote to find a single reel. Now we can scan all the receipts for a kit, or a family of kits, to one barcoded location at once, which has significantly cut down our kit times."

This streamlines the office-to-production handoff and SMT changeovers, reducing idle inventory.

Reel Handling: Separating Movement from Consumption

Sending full reels to the line complicates inventory control. Issuing the whole reel overstates WIP and hides the unused balance; issuing nothing leaves the system showing a reel on an empty shelf.

The ERP should treat moving material and consuming material as separate events, much like a library checkout that records who has a book without assuming it is used up. Cetec's Full Bin Pick uses the "All" button on the Pick Parts screen to allocate the entire bin to a work order and rename it to that order number, making the reel's location and ownership clear. Material is picked to BOM requirements to record consumption. Pick quantities can be adjusted once actual usage is known, usually when a pick-and-place job closes.

After the run, return the remainder with a bin move. An X-ray counter or smart inventory system can update actual quantities in ERP, keeping location, WIP, and job cost accurate.

The ERP as the Cornerstone

A full-suite ERP integrates inventory, purchasing, production, shop floor activity, quality, and accounting, providing a hub for specialized tools and freeing resources for valuable integrations:

- **Quoting:** Platforms cost the BOM and transfer it to ERP for planning and purchasing. Labor quotes become production labor plans, with work instructions where needed.



We've trained the industry's workforce since 1987. **Now let us train yours.**

An international leader in electronics manufacturing training. IPC certification, soldering, wire harness, inspection and rework at 24 North American centers, at your facility, or online.

SEE THE TRAINING SCHEDULE

300,000+	24	2	76
people trained	North American centers	IPC Hall of Fame instructors	Net Promoter Score

1-800-643-7822 training@eptac.com eptac.com/training

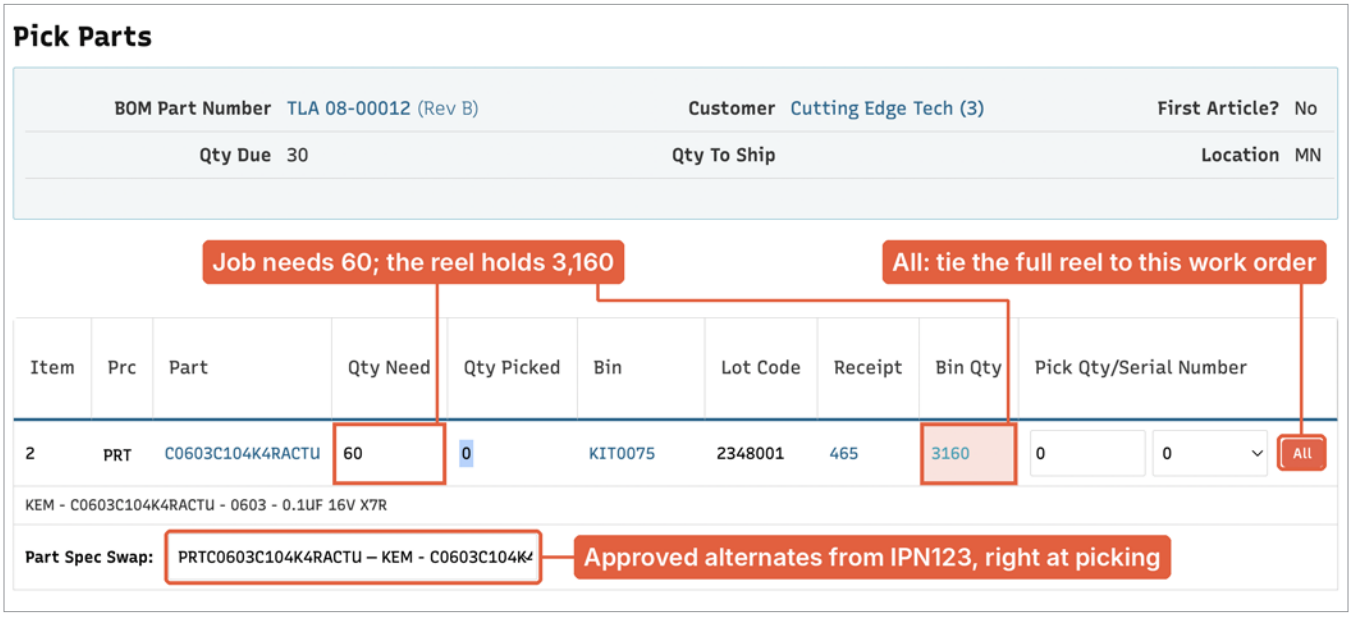


Figure 3: The All button ties the full reel to the work order by renaming its bin to the order number, but only the 60 pieces the job needs are picked into WIP. The Part Spec Swap offers the approved alternates from the part's Part Spec Group at the point of picking.

- **Procurement:** Supply chain platforms read ERP demand and MRP data, consolidate purchases by MPN, issue supplier POs, and return those POs to ERP.

- **Smart storage:** Systems receive ERP work orders, guide operators to the correct reels, and return quantities and locations, so operators and planners see the same location for every reel.

- **X-ray reel counters:** Counters return the remaining reel quantities to ERP, maintaining accurate inventory as partial reels are returned from production.

Native accounting posts inventory, direct labor, overhead, and outside services, such as conformal coating on Outsource POs, to jobs as work occurs. Costs reflect the build without reconciling another accounting system.

Centralized data also supports AI. Our MCP server lets agents query live sales, inventory, purchasing, production, and accounting data in plain language for reporting and analytics, and begin assisting with transactions, starting with creating quotes and BOMs.

Conclusion: Managing by Exception

Contract manufacturing will always be exception-based, and some exceptions will always require judgment: which alternate to propose to a customer, or which order to protect during a shortage. Reliable ERP processes reduce the routine work demanding hands-on management.

Each process that runs reliably inside ERP is one less task to manage by hand. That frees people to manage by exception: solving customer and supplier problems and investing in strategic improvements.

For S&Y Industries, that shift was a matter of growth. "We needed something that could scale, because we just couldn't hire enough people during the parts shortage to keep up with all of the demand and the changes," says Miers. "It's not like we can go hire 50 people right now."

That is how a small or mid-sized EMS company punches above its weight. A full-suite manufacturing ERP carries routine work, and people spend their time where human judgment matters.



Scott Ryan is a senior consultant at Cetec ERP.

ΩMEGA
ELECTRONICS MANUFACTURING SERVICES

Start the Conversation



Your 2027 roadmap starts with the right EMS partner.

Most EMS relationships start at kickoff. **Omega's start earlier** — with engineering oversight, DFM review, and a dedicated program manager before a single board is built. If you're planning your 2027 roadmap, now is the right time to talk.

> *We've been able to move faster to market because Omega simply executes.*
>
> TIM K. · VP HARDWARE ENGINEERING

Let's Talk About Your 2027 Programs

Start the Conversation

VISIT	CALL	EMAIL
omega-ems.com/contact	408-341-9739	info@omega-ems.com

- EMBEDDED DFM OVERSIGHT
- DEDICATED PROGRAM MANAGERS
- GLOBAL PRODUCTION CAPABILITY
- 80+ YEARS COMBINED EMS LEADERSHIP



The Universal Language of QUALITY

BY TIANMING LIU, FSQUALITY

When I began working in the PCB industry, I quickly learned that customers may describe quality differently, but they recognize it in the same way: A board either meets the drawing or it does not; it performs reliably, or it creates a problem; it arrives when promised, or it disrupts the customer's production schedule. There is very little room for interpretation.

My understanding of quality was shaped during the 13 years I worked in Japan. I saw how much attention Japanese manufacturers gave to preparation, documentation, cleanliness, and process discipline. At first, some of these practices seemed overly cautious to me. Over time, I understood their purpose. Quality is easier to protect when people think carefully before production begins.

When we established our company in China, I wanted to bring that discipline into an organization that could also move quickly and respond flexibly. That balance became part of the FSQuality philosophy. Speed matters to our customers, but speed without control creates more problems than it solves. Quality matters, but a perfect board delivered too late may still fail the customer.

PHOTONICS SYSTEMS GROUP

Zero Stress. Infinite Flexibility.

LASER DEPANELING REDEFINED



Micron-precise, clean, and stress-free PCB separation with today's advanced laser systems delivering unmatched performance at the lowest total cost in years. No compromises on quality or your bottom line.

- Non-contact cutting: Eliminates stress
- Clean, burr-free edges
- Higher yields & material savings: Tighter panel layouts reduce waste up to 30%

MACHINE FEATURES

Stand-alone or in-line • Upgradable lasers • Dual-head for volume



Various PCB materials



Laser cutting in action



Superior cutting quality

Contact us at
photonics-systems-group.com
T: +1 (419) 574-4965
T: +52 33 1158 6009

Working with customers in North America, Europe, Japan, and other parts of Asia has shown me that the basic expectations are remarkably similar. Customers want boards that meet specifications, arrive on time, and perform consistently. They also want honest communication when something does not go according to plan.

International standards help create this shared understanding. IPC requirements, ISO quality systems, customer specifications, and industry certifications give manufacturers and customers a common technical foundation. Engineers in the United States and China may speak different languages, but they can study the same drawing, review the same cross-section, and evaluate the same inspection data.

Standards are important, but I have also learned not to place too much faith in certificates. They do not build a good circuit board. Certificates show that a system has been reviewed, but the real test occurs every day on the factory floor. Operators must follow the process, engineers must investigate variation, and managers must support corrective action, even when it is inconvenient or expensive.

Real quality is found in habits that customers may never see, such as when the operator stops a process because something does not look right, the engineer studies a small change in plating thickness before it becomes a larger problem, and the manager refuses to ship questionable product simply because the delivery date is approaching.

Statistical process control has made these decisions more objective. We monitor processes, examine trends, and use data to understand where variation is developing. Copper thickness, drilling accuracy, line width, registration, impedance, and other critical characteristics cannot be managed by instinct alone. Data allows us to act before a customer is affected.

Still, data is only useful when people are willing to face what it says. One of the easiest mistakes in manufacturing is explaining away an unfavorable result. There is always pressure to keep production moving. A mature quality culture accepts that stopping briefly to understand a problem is often faster than producing more material that may need to be scrapped.

Technology has strengthened our ability to control quality. Automated optical inspection, electrical testing, X-ray equipment, digital records, laser measurement, and real-time production monitoring provide manufacturers with information they did not have in the past. AI will help us recognize patterns earlier and manage increasingly complex products.

However, I do not believe technology will replace human responsibility. Equipment can identify an unusual condition, but people must decide what it means and what to do. The best machine cannot compensate for weak training, careless communication, or leadership that values output more than integrity.

Customers also have an important role. Many quality problems begin before an order reaches the factory. An incomplete drawing, an unclear stackup, an unavailable material, or an unrealistic tolerance can create unnecessary risk. The strongest customer-supplier relationships allow engineers to discuss these issues openly before production. Asking for clarification is not a sign of weakness. It is evidence that the manufacturer is paying attention.

Manufacturers must also be honest when they make mistakes. Every factory, including ours, will experience problems. The true measure of a company is not whether it claims to be perfect. It is whether it responds quickly, identifies the actual cause, protects the customer, and prevents the problem from returning. Customers can forgive an honest mistake more readily than an evasive explanation.

Quality has become a universal language because results travel easily across borders. Customers remember suppliers that perform consistently, communicate honestly, and take responsibility. They also remember those that do not.

The future of global manufacturing will not belong to the country with the best reputation or the factory with the most certificates. It will belong to companies that make quality visible in their daily decisions. In the end, a quality system is not what a company says about itself. It is what its people are willing to do when no customer is watching. **SMT007**



Tianming Liu is president of First Quality Circuits Co. and Sihui Fuji Electronics Technology Co., Ltd. To read past columns, click here.

REDUCE SOLDER USAGE UP TO 85%



"Using MS2 Molten Solder Surfactant for Solder Dross Recovery has been extremely efficient and profitable for the company. We are getting 80% +/- recovery."

David Ramirez
SME Engineer in Guadalajara, Mexico

CALCULATE YOUR SAVINGS

+1 (800) 757-6533 | sales@pkaymetal.com

PK M·E·T·A·L

www.pkaymetal.com

BY RALPH RICHART, METISLOGIC



Finding Lead Time in the Messy Middle

As electronics manufacturers, we devote significant effort to the production floor, always seeking to build products better and faster. We measure placement speed, optimize changeovers, monitor yield, and invest in equipment. Those investments matter. But in many high-mix and new product introduction (NPI) environments, the greatest opportunity to shorten lead time sits between the customer order and the start of production.

I call this the Messy Middle. It is the period when a quoted job becomes a buildable job. During this time, the bill of materials changes: alternates are added, quantities shift, purchase decisions are made, and customer-supplied material arrives. Parts must be received, stored, allocated, and picked. Through it all, questions arise and pass between program management, purchasing, receiving, the customer, and the shop floor.

akrometrix

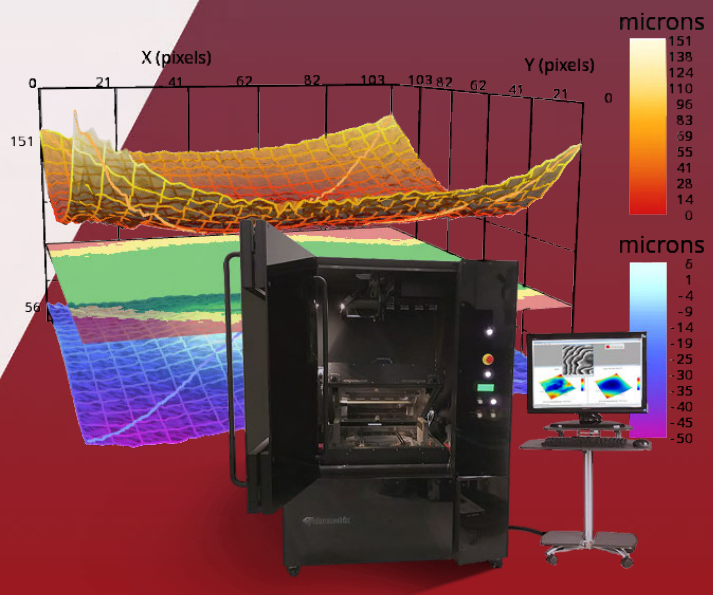
Thermal Warpage & Strain Metrology

REAL-TIME METROLOGY SOLUTIONS FOR DESIGN, TESTING AND MANUFACTURING

We are the leading manufacturer of equipment optimized for measuring and resolving thermo-mechanical surface flatness issues in electronic materials production, components fabrication, and assembly processes.

Our systems utilize our unique Shadow Moiré vision measurement techology for flat sufaces, and have the capability to utilize our add-on Digital Fringe Projection and Digital Image Correlation technologies, for measuring discountinuous surfaces, and CTE data over temperature.

We also serve customers who do not have their own Akrometrix equipment by providing testing services at our headquarter's lab facilities. Our applications engineering experts will provide accurate and timely information for all of your thermal warpage and strain metrology needs.



Send us your components, boards, assemblies, connectors, wafers, etc. to test today

www.akrometrix.com
sales@akrometrix.com
1-404-486-0880

Every one of those activities is necessary. The problem is that they are often managed across email, spreadsheets, shared drives, handwritten notes, and the memories of a few experienced people. Information is lost, and mistakes are made. Lead time slips away as teams work through the problems of the Messy Middle. Because so much of that time is lost before production even begins, preproduction is one of the best places to win it back.

> **When the formal system does not reflect the detail people need, they build a parallel system.”**

Where Status Goes to Hide

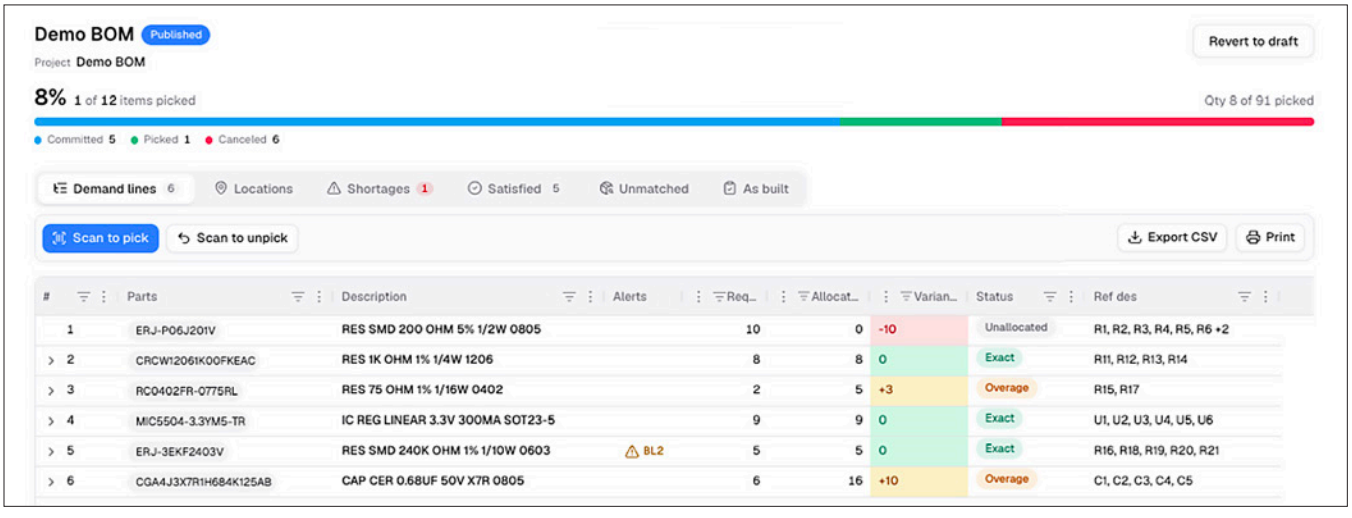
The Messy Middle begins as soon as reality moves away from the quote. A customer releases an order, but the production BOM differs from the quoted BOM. Perhaps a distributor substitutes a different package, or customer-supplied material arrives from a different manufacturer than expected. A promised shipment arrives in three boxes instead of one. A part appears on the packing slip, but the carton contains something else. Another part is physically in the building but awaiting inspection, so it has been received but is not yet usable.

None of these exceptions is unusual. In a job shop, exceptions are the norm, yet many systems and processes assume a much cleaner progression from sales order to production. When the formal system does not reflect the detail people need, they build a parallel system. One program manager keeps a shortage spreadsheet. Purchasing has a separate list of open commitments and tracking numbers. Receiving has boxes on a cart with notes attached. The customer receives status from whichever source someone checked most recently. Each workaround may make sense on its own, but together they create competing versions of the job.

The Consequences Compound

The first visible bottleneck is often the Receiving Department. Boxes arrive faster than operators can identify, validate, and add them to inventory. Long supplier part numbers must be read and entered correctly. Purchase order data, quantities, date codes, lot information, and locations may all need to be captured, often manually. When the process is slow, error-prone, or ambiguous, material piles up or is received incorrectly. A box can be inside the building while the rest of the company still behaves as though the parts are missing.

Then comes coordination drag. Program managers chase receiving for updates, ask purchasing to



#	Parts	Description	Alerts	Req...	Allocat...	Varian...	Status	Ref des
1	ERJ-P06J201V	RES SMD 200 OHM 5% 1/2W 0805		10	0	-10	Unallocated	R1, R2, R3, R4, R5, R6 +2
2	CRCW1206K00FKEAC	RES 1K OHM 1% 1/4W 1206		8	8	0	Exact	R11, R12, R13, R14
3	RC0402FR-0775RL	RES 75 OHM 1% 1/16W 0402		2	5	+3	Overage	R15, R17
4	MIC5504-3.3YM5-TR	IC REG LINEAR 3.3V 300MA SOT23-5		9	9	0	Exact	U1, U2, U3, U4, U5, U6
5	ERJ-3EKF2403V	RES SMD 240K OHM 1% 1/10W 0603	BL2	5	5	0	Exact	R16, R18, R19, R20, R21
6	CGA4J3X7R1H684K125AB	CAP CER 0.68UF 50V X7R 0805		6	16	+10	Overage	C1, C2, C3, C4, C5

Figure 1: Easy-to-use allocation screens provide clear order status.

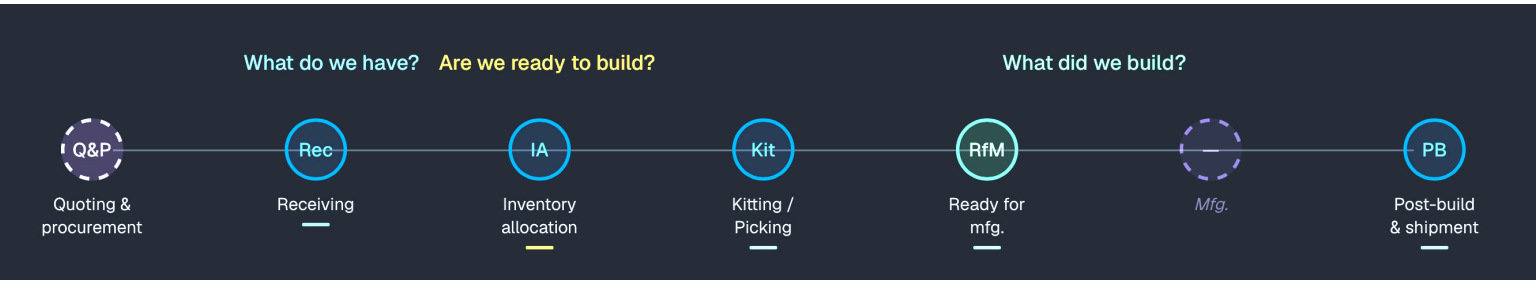


Figure 2: Example workflow for allocating inventory to jobs and creating pick lists.

reconfirm tracking numbers and delivery confirmations, check spreadsheets, and respond to customers with partial information. The time spent searching and reconciling does not make the job more ready. It only confirms how unready the job is and exposes how unreliable the process has become.

Eventually, the disorder reaches production. A job is scheduled because the top-level status looks green, only to find that a critical line item is short, in inspection, assigned to another build, or sitting in an unknown location. The production line stops, or the job is pulled. Schedules are rearranged, materials are restaged, and another customer commitment is put at risk.

Urgency costs follow. A part that cannot be found may have to be purchased again or, worse, requested from the customer again. Standard freight becomes expedited freight. A job that could have been done during normal hours now requires overtime or a weekend shift. In the worst case, the wrong part reaches a board because the connection between what was intended, what was received, and what was issued was never strong enough.

These costs appear in different departments, making the root cause easy to miss and the total cost hard to quantify. Logistics sees an expedite fee. Operations sees an overtime bill. Finance sees a write-off. The customer sees a late shipment. All of it traces back to the same missing connection in preproduction.

ERP Alone Isn't the Answer

ERP remains essential. It is excellent at financial control, purchasing transactions, inventory valuation, and the disciplined records a company needs to operate. ERP can also support scheduling, but a schedule is only as reliable as the readiness of the information it relies on. The issue is often not what the system can do, but how employees are asked to do it.



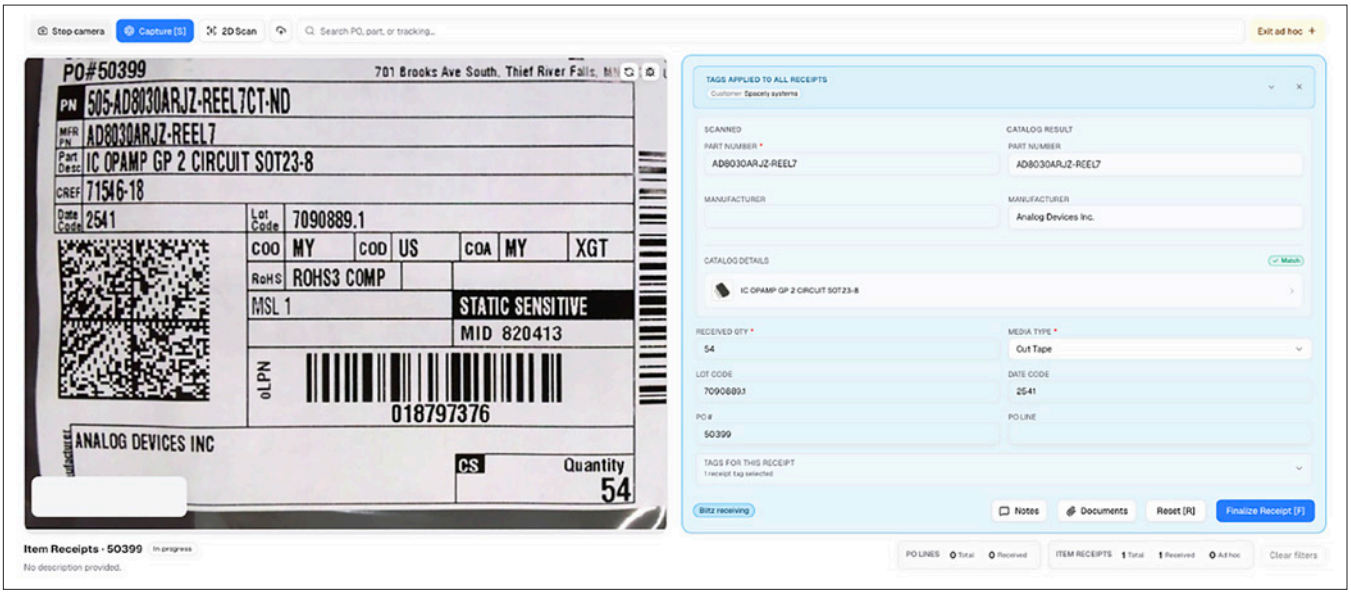


Figure 3: Automated Label Ingestion saves keystrokes and improves accuracy.

Many ERP interfaces are designed around transactions and records rather than the physical flow of work in a high-mix EMS environment. Receiving operators may need to move through multiple screens to process a shipment. Program managers may need to open several records to determine whether the material has arrived, been assigned to the right job, or is truly ready to build.

That friction matters because these queries are performed repeatedly, under time pressure, by people whose primary skill is manufacturing, not ERP navigation. When the interface is slow or poorly matched to the work, employees create spreadsheets, notes, and shortcuts around it. The ERP may still contain the official record, but the real operating picture is outside the system.

The answer is not to replace ERP. It is to maintain the ERP as the financial and transactional system of record while giving the people managing material readiness a purpose-built interface for their work. That interface should be optimized for receiving material, reconciling it to demand, allocating it to the right job, and preserving a record of decisions. The validated results can then flow back to ERP and the other systems that depend on them.

Make Scarce Talent More Effective

The talent gap makes this issue more urgent. Because they must communicate with customers, understand technical details, coordinate across departments, and keep multiple jobs moving at once, program managers are among the hardest roles for many shops to fill. In shops without a uniform process, program managers must also invent their own method for tracking the Messy Middle. That combination narrows the hiring pool and makes the company dependent on individual habits.

A highly experienced program manager may run an excellent private system, but it can be difficult to transfer, audit, or scale. When the process is structured and easy to follow, the company can hire for judgment, communication, and technical aptitude without also requiring every new employee to design a personal operating system.

Receiving faces a similar challenge. Receiving operators are often the first line of incoming quality. They notice damaged packaging, incorrect quantities, unexpected labels, and discrepancies between what was ordered and what arrived. Their attention should be on determining whether the material is correct and acceptable, not navigating cumbersome screens or repeatedly typing long strings from supplier labels.

Purpose-built tools can reduce the transaction burden, freeing these highly valued employees to spend more of their time on decisions that leverage their experience.

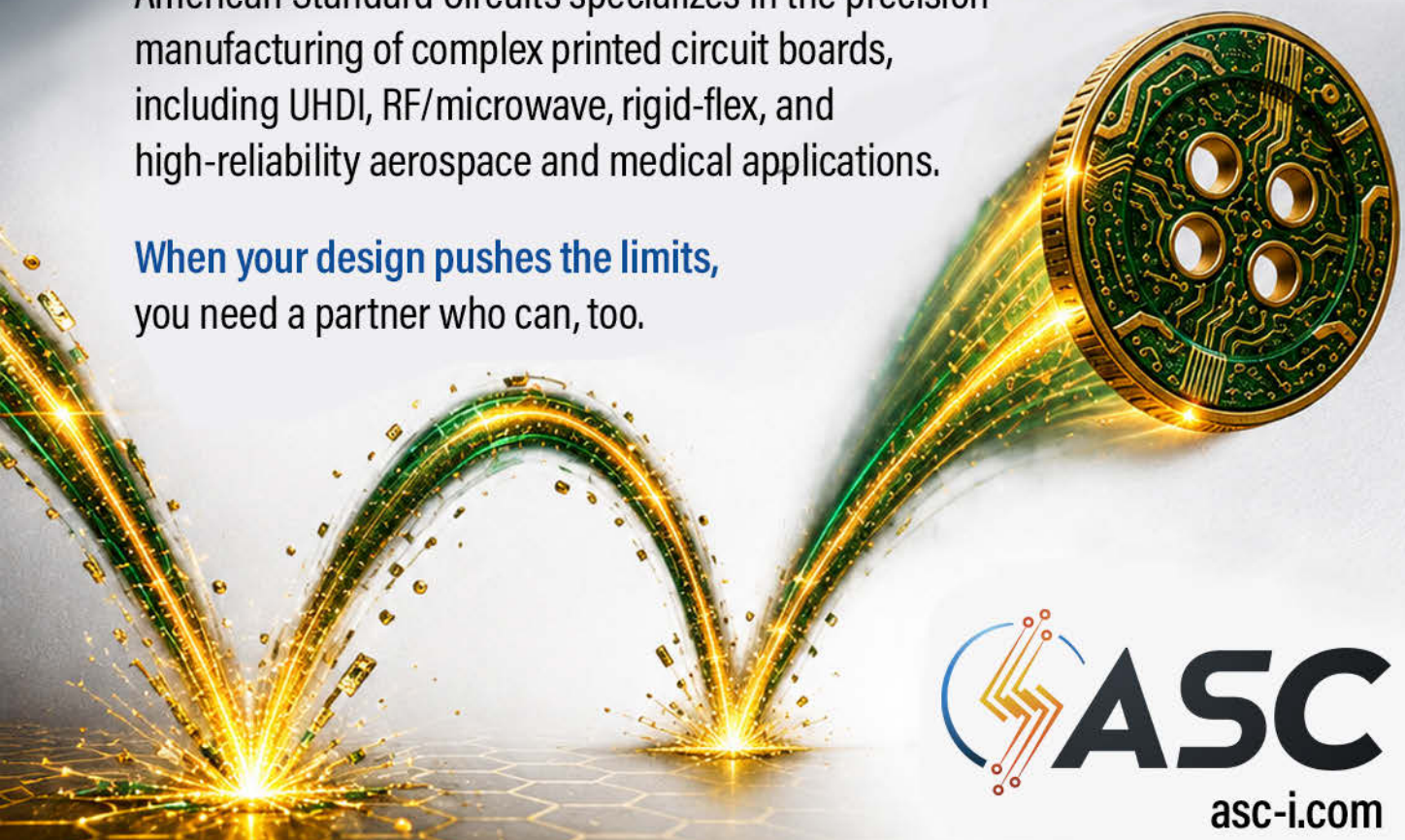
Stressed By TIGHT Tolerances?



RELAX. *Your specs won't have us bursting at the seams.*

American Standard Circuits specializes in the precision manufacturing of complex printed circuit boards, including UHDI, RF/microwave, rigid-flex, and high-reliability aerospace and medical applications.

When your design pushes the limits,
you need a partner who can, too.



ASC
asc-i.com

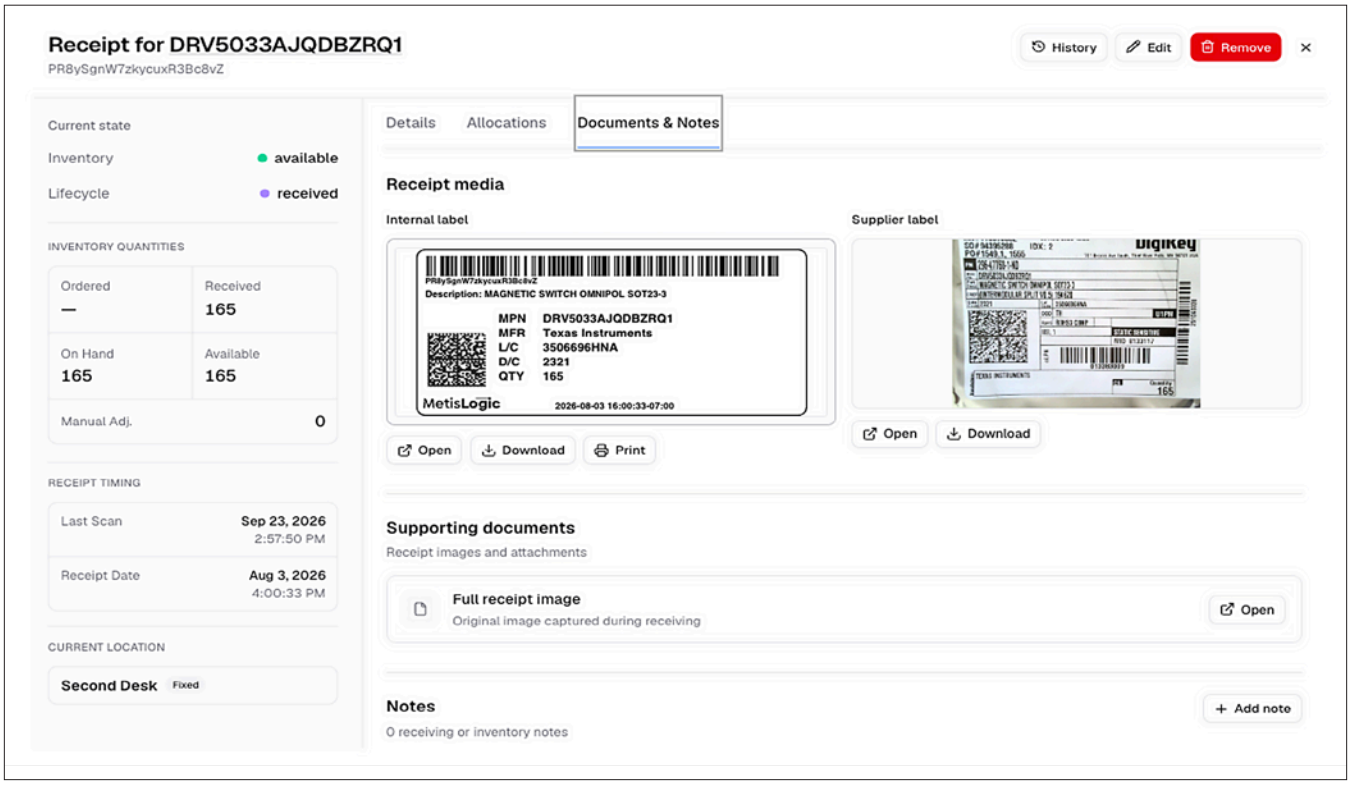


Figure 4: Centralized data provides traceability.

Why I Founded MetisLogic

This company grew out of my experience managing the Messy Middle. I had sat through endless clear-to-build meetings, seen wrong parts end up on boards, and watched lines stop when gaps remained invisible until production. I watched teams lose hours reconciling material that differed from expectations. I had also seen jobs ship late or be rescued with overtime and weekend work after preproduction consumed nearly all the available lead time.

Those experiences changed how I thought about manufacturing efficiency. Software cannot make a component arrive sooner than a supplier can ship it, and a factory cannot recover time already lost. When most of the lead time is spent determining whether a job is ready, production inherits the risk, and the customer pays for the uncertainty.

That is why we built a connected workflow for the Messy Middle, not simply to digitize a spreadsheet, but to keep material, demand, changes, allocations, and actual usage connected to customer intent. With that structure, manufacturers can identify gaps earlier, communicate status confidently, and preserve the traceability needed to explain what was built.

The same principle applies beyond job shops. OEMs have similar handoffs among teams. Departments are internal customers of one another, and information can disappear at those boundaries just as easily.

The Messy Middle will never be free of change. Electronics manufacturing has too many parts, revisions, suppliers, and exceptions. The opportunity is to use a purpose-built tool to manage these changes within a single, connected workflow. When the preproduction workflow is connected, the company gets time back before the factory ever starts.

The goal is not to eliminate human judgment. It is to make the facts and decisions visible so people can apply judgment quickly and consistently. That recovered time can be used where it creates more value: building the correct product, protecting quality, and delivering when the customer expects it.

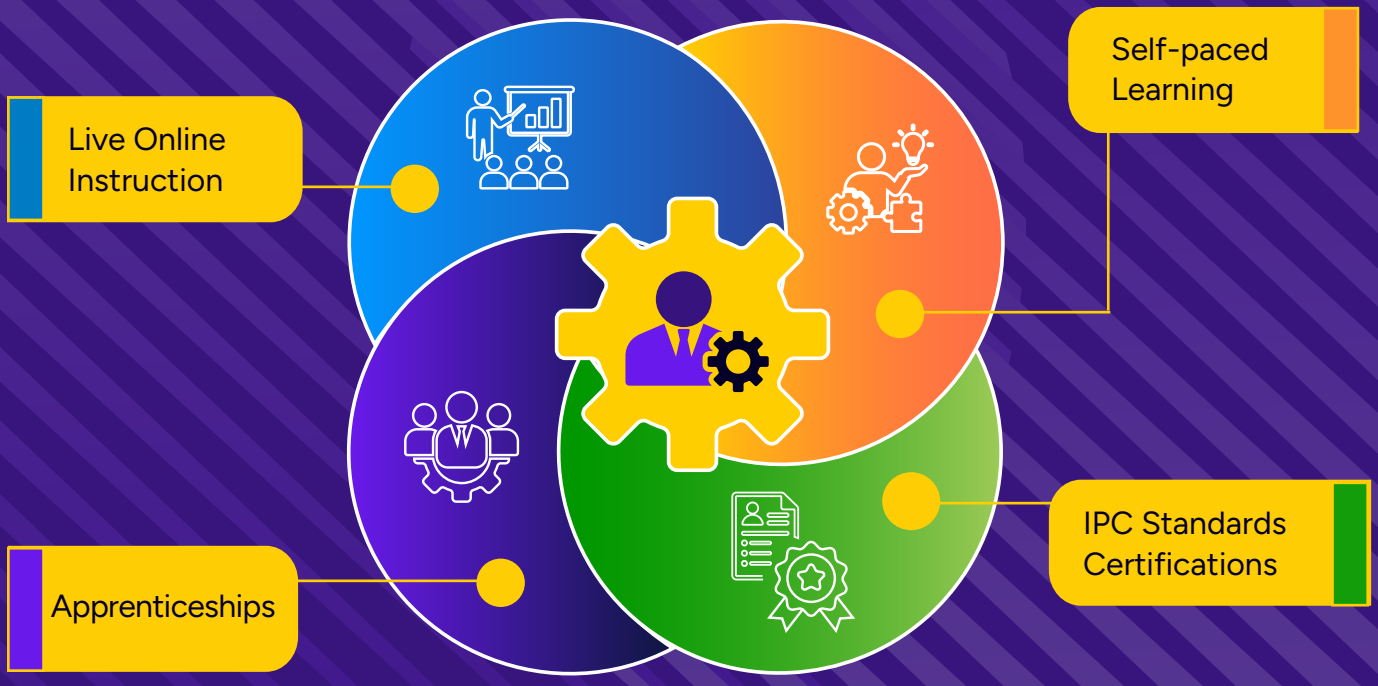


Ralph Richart is the founder and CEO of MetisLogic.

Electronics U
by Global Electronics Association

YOUR ELECTRONICS EDUCATION, CONNECTED

Electronics U and Global Electronics Association bring together self-paced learning, live online instruction, apprenticeships, and IPC Standards Certifications to create a connected education ecosystem for the electronics industry.



EXPLORE THE LEARNING ECOSYSTEM

www.electronicsu.org/connected-ecosystem-electronics-education

Genie Space Edge Processor Achieves Space Heritage With Successful U.S. Space Force Mission ▶

The successful mission marks a significant step in the evolution of space-based computing by bringing powerful computer vision autonomy directly to the spacecraft, while enabling AI-driven autonomy and real-time RPO mission processing in space.

Yank Technologies Wins NASA Contracts for Lunar, Mars Wireless Power ▶

Yank Technologies is developing two new wireless power systems for the Moon and Mars: a modular wireless power system for umbilical applications and high-power density kilowatt AC-DC converters with self-diagnostics.

For Cybersecurity Certification, a Pause Is Not a Pass ▶

For contractors who store, process, and/or transmit controlled unclassified information, CMMC implementation is not optional. The DoD paused Phase 2 on July 13 and initiated a 60-day review of the CMMC program. For contractors racing toward a completed assessment by the original enforcement date, the obvious question becomes: Does that mean we can stop?

Airbus Completes Quarkslab Acquisition ▶

Acquisition of the French cybersecurity company Quarkslab follows regulatory approvals. This investment is another step in Airbus' strategy to reinforce its position as a trusted, sovereign partner for French authorities, while expanding its footprint in the European cybersecurity landscape.

Defense Speak Interpreted: The Impact of Venture Capital-backed Defense Contractor Firms ▶

There are several nimble new Defense contractors exploding in size—Anduril Industries, Saronic, Shield AI, Mach Industries, Castellian, among them. Why are venture capitalists, the wizards of the financial future, backing these companies in an industry segment that they traditionally wouldn't touch?

Virtus Solis Signs 20-Year Space Solar PPA with Brae Systems for 250 MW Clean Power ▶

Virtus Solis will supply 100 MW of 24/7 orbital solar baseload power, delivering 876,000 MWh annually, via a dedicated terrestrial receiving station to be constructed in Illinois.

U.S. Navy Doubles UAS Command Capacity with Second MD-5C ▶

The U.S. Navy has doubled its fleet capacity to operate the MQ-25A Stingray™ unmanned aircraft system (UAS) over a five-month period. USS Theodore Roosevelt (CVN 71) received the first operational MD-5C in March 2026, followed by USS Ronald Reagan (CVN 76) in August 2026.

RTX's Raytheon Wins $24.4B Multi-Year SM-6 Contract ▶

Building on landmark agreements between Raytheon and the Department of War, this long-term order ensures a consistent, reliable supply of SM-6s for the U.S. Navy. SM-6 is the only combat-proven weapon that can perform anti-air warfare, anti-surface warfare and ballistic missile defense.

Satellite IoT Subscribers to Reach 42M by 2030 ▶

Only about 10% of the Earth's surface has access to terrestrial connectivity services, which leaves a massive opportunity for satellite IoT communications. Satellite connectivity provides a complement to terrestrial cellular and non-cellular networks in remote locations

Northrop Grumman Continues In-Space Industry Leadership With New Facility Opening in Arizona ▶

Northrop Grumman is deepening its long-term commitment to Arizona and the greater Phoenix metro area as a key hub for advanced manufacturing and space engineering, creating high skilled jobs, bolstering the regional industrial base, and helping shape the future of the U.S. space economy.


We are dedicated
to excellence through
innovation,
technology
and most importantly,
service.
COMMERCIAL • MILITARY • MEDICAL • BAREBOARD
U.S.C.
U.S. CIRCUIT
www.uscircuit.com
ISO
9001 CERTIFIED
ITAR

ROSE Testing Has Its Limits



BY DR. ADAM KLETT, KYZEN

Few cleanliness tests have enjoyed the popularity of ROSE. In almost any electronics manufacturing facility, you'll likely find a tester quietly producing results. For many years, these numbers were treated as the ultimate measure of cleanliness. If the value was below a specified limit, the assembly was considered clean. If it exceeded the limit, corrective action followed.

The clean truth is that ROSE testing is neither as powerful nor as flawed as its strongest supporters and critics claim. Like any analytical tool, its value depends entirely on understanding what it actually measures and applying it appropriately.

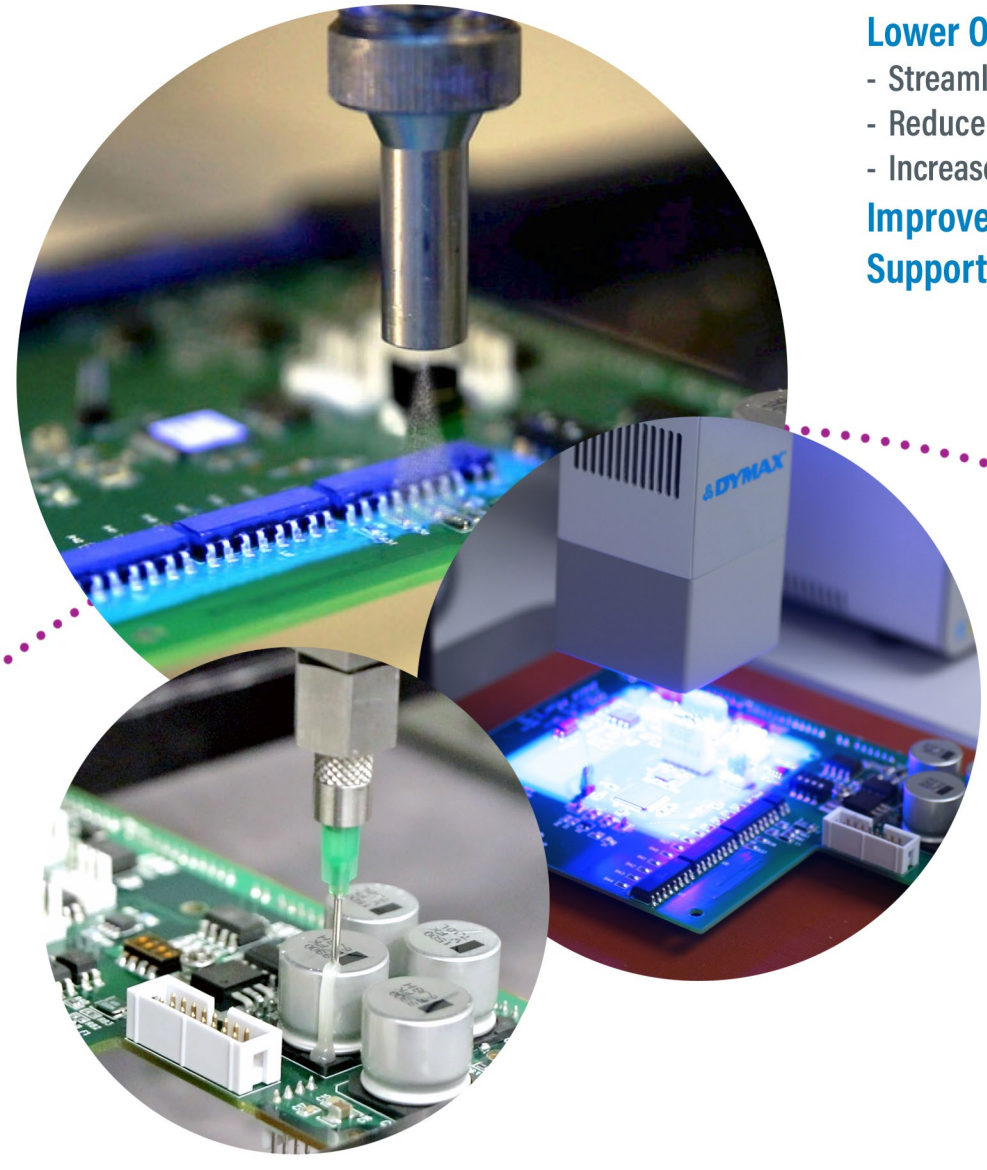
What Is ROSE Testing?

ROSE stands for "resistivity of solvent extract." At

DYMAX®

Light-Cure Adhesives and Equipment for Advanced Electronics Assembly

Bond, Coat, and Seal critical PCBs and board-level components.



Lower Operational Costs
- Streamline Assembly
- Reduce WIP & Waste
- Increase Throughput

Improve Reliability

Support Sustainability

See Solutions

dymax.com

its core, it is a conductivity measurement. A circuit board or assembly is submerged in a mixture of isopropyl alcohol and deionized water, and any soluble ionic residues are extracted into the solution. As ions dissolve into the solvent, the conductivity increases. The instrument converts this conductivity change into a reported value expressed as sodium chloride equivalents.

This is an elegant concept because conductivity measurements are fast, inexpensive, and easy to perform. A ROSE test can typically be completed in minutes, making it attractive for production environments where rapid feedback is essential.

The key point, however, is that ROSE does not directly measure failure risk. It's important to understand that it measures the conductivity of an extract solution and uses that measurement to estimate the amount of ionic contamination that was removed from the assembly.

What ROSE Testing Does Measure

ROSE testing is effective at answering one specific question: How much soluble ionic material was extracted from this assembly?

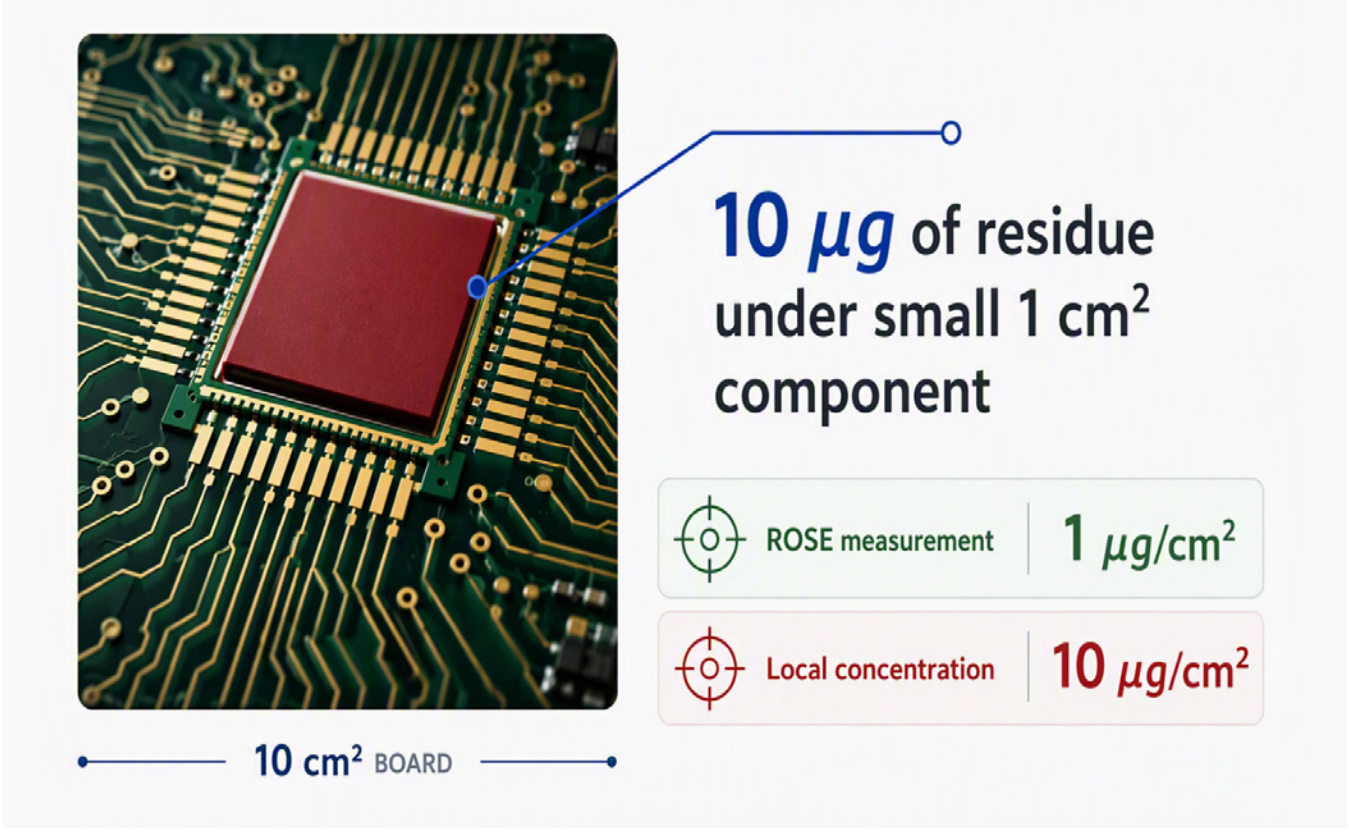
The result provides a bulk indication of soluble contamination. In other words, it tells us whether the overall process appears to be introducing more or less extractable ionic residue over time.

This makes ROSE particularly useful for monitoring the consistency of the cleaning process and tracking contamination trends to support statistical process control (SPC). When a cleaning process has been properly validated, ROSE can serve as an early-warning system. A sudden increase in ROSE values may indicate rinse problems, chemistry concentration issues, maintenance concerns, or contamination entering the process.

In short, ROSE is very good at telling us when something has changed.

What ROSE Testing Does Not Measure

This is where confusion often begins as ROSE does not identify individual contaminants. Unlike ion chromatography, it cannot distinguish chloride from adipate, sodium from ammonium, or a benign residue from a highly corrosive one. Everything is converted into a conductivity measurement and then reported as sodium chloride equivalents.



GREENSOURCE
FABRICATION

Built for What's Next in Advanced PCB Manufacturing



Reliability

Highly reliable stacked and staggered microvias (50 to 250 µm), backed by industry-leading blind via formation.

Sustainability

Environmentally sustainable Zero Liquid Discharge (ZLD) wastewater treatment system.

Capability

Sub-35 µm features with advanced mSAP and SAP trace formation.

100% USA Made | ISO 9001 | AS9100 | ITAR Registered

greensource.us

info@greensourcefab.com

Scan to learn more

ROSE also does not reveal where residues are located. A small amount of contamination trapped beneath a bottom-terminated component may pose a significant reliability risk, while a much larger amount distributed elsewhere on the board may be relatively harmless. ROSE averages everything together into a single bulk result.

Perhaps most importantly, ROSE does not directly measure electrical reliability.

A board can produce a low ROSE number and still experience electrochemical migration, corrosion, insulation resistance degradation, or dendritic growth under service conditions. Conversely, a board may produce a relatively high ROSE result and still perform acceptably in its intended environment. The relationship is not always straightforward because reliability depends on many factors, including residue chemistry, location, moisture exposure, electrical bias, assembly design, and operating conditions.

This reality is one reason IPC cleanliness requirements evolved away from universal ROSE limits and toward objective evidence approaches centered on actual reliability testing.

Why the Industry Changed Its Thinking

Historically, the famous 1.56 µg/cm^2 sodium chloride equivalent limit became widely accepted as a cleanliness benchmark. For many years, passing this limit was often viewed as evidence that a product was clean enough for service.

Modern electronics changed the equation.

Assemblies today contain smaller geometries, lower standoff components, denser packaging, and more complex chemistries than the assemblies for which many of the original cleanliness assumptions were developed. Modern flux residues may be only partially extractable, highly localized, or chemically different from the contaminants that dominated reliability concerns decades ago.

As a result, IPC-J-STD-001 evolved toward an objective-evidence model. Surface insulation resistance (SIR) testing became the preferred method for demonstrating that residues do not adversely affect reliability under temperature, humidity, and electrical bias conditions. ROSE remains valuable, but primarily as a process-monitoring tool rather than a qualification tool.

The Appropriate Use Case for ROSE

The best way to think about ROSE is as a process control instrument, not a reliability predictor.

An ideal approach looks something like this: First, qualify the manufacturing process using objective evidence such as SIR testing, environmental testing, historical reliability data, or other appropriate methods. Establish that the process consistently produces assemblies suitable for the intended service environment.

Next, measure the corresponding ROSE values produced by that validated process. These values become your baseline.

Once those process-control limits are established, ROSE becomes extremely useful. If future production runs begin generating ROSE values that fall outside the validated range, the manufacturing team knows something has changed and can investigate before larger problems develop.

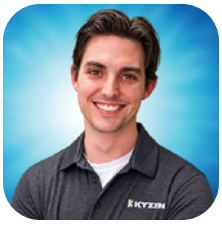
In this model, SIR tells us whether the process is acceptable. ROSE helps us determine whether the process remains consistent.

The Clean Truth

ROSE testing has survived for decades because it provides something manufacturing engineers desperately need: fast feedback. It is inexpensive, practical, and sensitive enough to detect meaningful process changes. The mistake is expecting it to do more than it was designed to do.

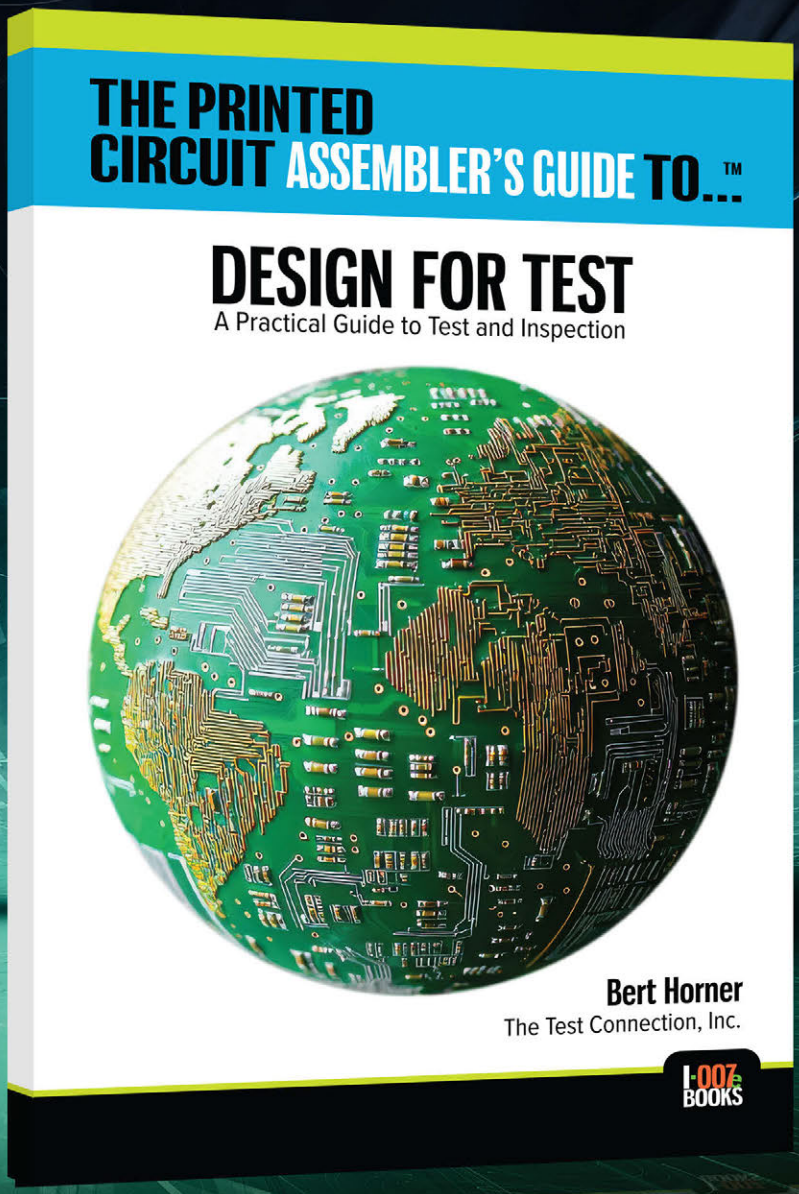
ROSE measures extractable ionic contamination. It does not identify contaminants, locate contaminants, or directly predict reliability. It should not be used as standalone evidence that a manufacturing process is qualified for high-reliability electronics. When used as a process-control tool anchored in a validated cleanliness program, ROSE remains one of the most useful measurements available to electronics manufacturers. When used as a universal pass/fail indicator of reliability, it can be misleading.

That's the clean truth. **SMT007**



Dr. Adam Klett is director of science at KYZEN. To read past columns, click here.

The Assembler's Playbook for Modern DFT



Look Inside

"Even experienced test professionals will gain valuable insights and fresh perspectives from the author's expertise."

—William E. Webb, Aster Technologies

I-007eBOOKS

The Hidden Costs of TARIFF STACKING



For OEMs and EMS providers, the country of origin of individual components, additional duties, and changing trade policies can complicate everything from quoting to supply chain planning. Moving electronics manufacturing from one country to another doesn't necessarily eliminate tariff exposure. Mark Zetter of Venture Outsource LLC has applied his expertise, along with a team of operations and finance professionals, to enable OEMs and EMS companies to better evaluate landed costs, sourcing alternatives, and the financial risks of shifting the production chain. In this Q&A, Zetter explains the problem and his solution.

Mark, what exactly is a tariff stack, and why does understanding it matter for OEMs and EMS companies making sourcing decisions?

A tariff stack is an aggregate of duties, taxes, fees, and trade measures applied to a product when it crosses a border. It is not just the headline tariff rate,

BLACKFOX
Premier Training & Certification

IPC AUTHORIZED TRAINING CENTER

Premier IPC training and certification for your electronics team.

In person, live online, or an instructor at your facility.

UNITED STATES

Longmont, CO
Phoenix, AZ

MEXICO

Guadalajara
Querétaro

SOUTHEAST ASIA

Penang, Malaysia
Singapore

- Six IPC standards, at CIS, CSE and CIT level
- Space Addendum for J-STD-001 and IPC/WHMA-A-620
- Every course led by a Master IPC Trainer
- Training the industry since 1996

SEE THE TRAINING CALENDAR

(888) 837-9959 QUESTIONS@BLACKFOX.COM blackfox.com

the main figure typically reported in news headlines. For any given shipment, the stack depends on:

- Importing country
- Country of origin
- Harmonized Tariff Schedule (HTS/HS) classification
- Customs value
- Trade agreements or preference programs
- Whether the product/item is subject to trade remedies or special measures
- Entry type and logistics route



The HS line is the classified item, and the duty stack is on the HS line. The HTS code is what you type to open that line. With TariffVault, every layer of the stack on that line is in a single workspace, so the product's cross-border cost is the full stack. TariffVault scores the full tariff stack on the exact good you enter, so the absorb, pass-through, or relocation decision can be made before the program is committed, not only the landed cost and the risk of shifting production.

So, understanding the full tariff stack goes beyond simply knowing the duty rate. How does that information affect the sourcing and manufacturing decisions EMS companies make?

The tariff stack affects true landed-cost modeling, which is what supply chain teams optimize for, not the lowest tariff rate. Knowing the full stack helps teams make more effective sourcing, assembly location, or inventory strategy decisions.

On some electronics from China, for example, the total import duty is above 40%. That duty applies to the product's customs category, which is the HS and HTS code mentioned earlier. We show you each duty in that total, all on one screen. Added together, they are the full import duty, or tariff stack, on the product. Here are some examples.

- A higher-cost supplier in a Free Trade Agreement (FTA) country may still be cost-effective over a cheaper supplier in a high-tariff country once duties are included.
- Moving final assembly to another country does not move Section 301 if the PCB stays sourced in China.
- Understanding rules of origin, where tariffs apply, regional value content, and substantial transformation also improves BOM engineering and helps you determine whether a product can qualify for a better rate.

Because tariffs can change quickly, nimble teams will model scenarios: What if Section 301 increases? What if an exclusion expires? What if we move assembly to Vietnam or Mexico? This visibility turns the tariff stack into a dynamic decision variable.

In short, we have an informational/analytical tool helping users answer: What tariffs apply to my products, what is the real effective duty rate, how much exposure do I have, and what changes or mitigation options matter?

You've worked with OEMs and EMS providers on sourcing and manufacturing decisions for years. What challenges were you hearing from these companies that prompted you to develop this approach?

We took this on after talking with people at OEM and EMS companies who make landed-cost decisions, and hearing about their problems and the fixes they had already tried. Their issues kept resurfacing, and few could see the full effects of the variables because the formulas were incomplete.

I wanted a sourcing lead that opens a line already loaded, compares origins, and shows how the tariff is divided across the absorb, pass-through, and relocate strategies, so that the rest of the program management decision-making is based on those allocations. Those decisions are in NPI positioning and launch, a program transfer from OEM to EMS, or a move from one EMS factory to another. Each one is a geography choice, a cost choice, and a staffing choice. The OEM owns the import and the duty. The EMS quotes against the same tariff line, so both sides work from one number.

The Modeler scores those three together: origins allocation, tariff impacts, and what these do to program cost, as well as the support headcount required to

Flexible Circuit Technologies | inTFlex

The EMS Group of Flexible Circuit Technologies

FLEX SOLUTIONS
ENGINEERED FOR INNOVATION

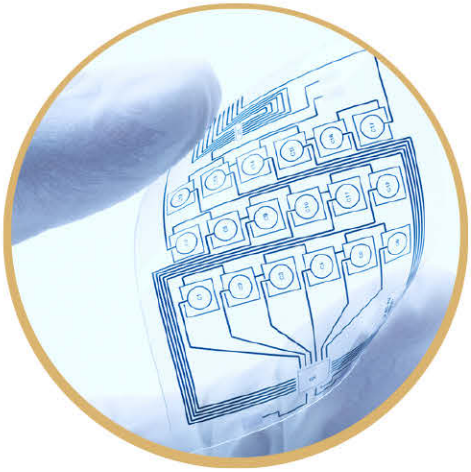
Industry-leading flex design services, premier in-house manufacturing of flexible circuits and EMS services



Flexible Circuits



Integrated Solutions



Printed Electronics

Superior Design Support
From Prototypes to Production

OUR PRODUCTS

- Flexible Printed Circuits
- Catheter Flexible Circuits
- Flexible Heaters
- Flat Flex
- Printed Electronics
- Circuit Assemblies
- Plastic Moldings
- Product Box Builds

SINCE 2000

OUR SERVICES

- Design Consultation & Optimization
- Prototyping
- Manufacturing & Assembly
- Testing & Traceability
- Inventory Stocking
- Program Management
- Turnkey Services
- Advance Manufacturing

sales@flexiblecircuit.com 763.545.3333 flexiblecircuit.com

execute the NPI or transfer. That was the piece that was missing from the formulas. The line, the origin, and the people required to move the program sit on the same page before the program is committed. The Modeler scores outsourcing program support headcount and cost for the NPI or the transfer. It does not, however, price the SMT/PCB assembly line. That direct labor stays in the factory quote.

Moving a program also involves staffing and support costs that need to be considered alongside tariff exposure and manufacturing expenses.

That makes sense. Understanding tariffs is hard enough; when they change often, it's even worse. How does the information you provide add value for users in understanding their tariff exposure?

To be clear, the TariffVault Decision Layer is not an AI program; it is a proprietary methodology based on 25+ years of our experience in scoring electronics programs, sourcing judgments for classification, true landing cost and duty calculations, and supply chain tariff-risk planning. Fragmented public tariff, trade, and policy feeds data go in, and usable, auditable information comes out. TariffVault is three tools on one Decision Layer. The Report scores the landed tariff stack, the Atlas maps country and corridor risk, and the Modeler tests absorb, pass-through, and relocation. They are named tools, not one generic service.

The platform provides information on:

- MFN/HTS/HS code rates by product and country
- Preferential rates: FTA, GSP, USMCA, and other trade-program rates
- Additional trade measures: Section 301, Section 232, Section 201 safeguards, AD/CVD, quotas/TRQs, and exclusions
- Other import charges: MPF, HMF, VAT/GST, excise taxes, and similar fees depending on jurisdiction
- Effective duty rate/landed-cost estimates: combined tariff burden vs. one line item
- Change tracking: New tariffs, rate changes, exclusions, expirations, scope rulings, and effective dates
- Scenario and exposure analysis: How tariffs apply by SKU, country of origin (supplier geography), value, and sourcing scenario

TariffVault adds value by centralizing complexity. It replaces scattered government portals, Federal Register notices, FTA rules, and AD/CVD orders with one structured view. Users can see why an item's true duty rate is much higher than the base rate. It also quantifies exposure by translating tariff rules into dollar impact for each product, supplier, country, or business unit, enabling faster decision-making.

Users can compare sourcing alternatives, model changes in the origin country, and evaluate exclusions and the impact on pricing or margins. It also improves compliance and planning, enabling procurement, finance, trade, and legal teams to work from a shared view of tariff exposure.

How do you envision this fitting into a typical workflow at an EMS company's purchasing department?

It sits in the quoting stage, next to the ERP and distributor portals, without replacing either. The ERP and portals still own the BOM, AVL, RFQ, and PO. It won't parse a full BOM, issue an RFQ, or create a PO. Electronics HS lines come preloaded. The buyer enters the code shown on the quote and reviews the Full Report for the top 30 BOM line items. This functions as the intake step for an internal EMS quoting buyer or commodity manager. The OEM customer program is being quoted for a particular country and factory. For each code, the Report presents the origin-based stack:

- MFN
- Section 301
- Section 232
- Any reciprocal surcharge
- AD/CVD
- Identifies countries that dominate global supply for the code

With supply chain bifurcation on the rise, TariffVault improves single-source vs. dual-source decisions for EMS factories. A single-source problem exists when a single origin supplies all imports. A second factory adds supply chain continuity and resilience. The duty shifts only if the circuit board's origin shifts. For example, if final assembly moves to India or Vietnam but the PCB is still manufactured in China, then Section 301 remains applicable to a China-origin PCBA.

EMS providers' OEM customers are responsible for import and duty. Under turnkey work, the EMS provider is not the importer of record. The turnkey-or-consigned choice determines who purchases materials. Duty follows the OEM's border entry decisions. Ultimately, the OEM decides whether to absorb it, pass it through, or relocate.

Before the figure reaches the EMS program team, our Modeler feature runs up to three origin scenarios and displays the tariff hit, the split, and the workforce impact of moving manufacturing. Another feature, the Atlas, then indicates whether the alternate origin is just as concentrated and exposes whether a supply chain corridor or a policy sits above it. UFLPA forced-labor risk and Entity List proximity are flags that also show on origins. A separate HTS classification, and the stack attached to that line, can be reviewed alongside the code in the OEM customer's quote.

The MFN rate on that line is only a few percent. A buyer who glances at it may treat it as a rounding error. The stack exposes the actual figure: A stack for a wire harness product may reveal, for example, a Section 301 at 25% for China origin, plus the forced-labor 301 layer. The wire harness serves as a material duty line, demonstrating that the stack is origin-driven. If the OEM moves final assembly to India or Vietnam while the harness remains China-origin, Section 301 will remain. Duty follows the harness entry, not the assembly location.

What's the usage model?

The model is a license, not a subscription, with considerable free information.

At no charge, any visitor can open a report on an electronics HS line. It shows the effective duty rate for China (baseline), Mexico, Vietnam, and India. One more origin can be added to the same comparison. It does not open the rest of the report.

A one-year or lifetime license key opens the full HTS Supply Intelligence Report, the Electronics Sourcing Risk Atlas, and the Workforce and Sourcing Scenario Modeler. One key covers every tool. The key arrives by email. Paste it once. No account, no password, no subscription, and no auto-renewal.

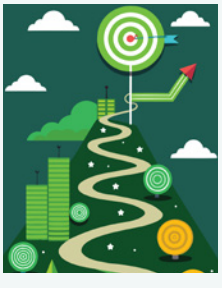
The China, Mexico, Vietnam, and India set is our default comparison. The rule-by-rule stack, Atlas, and Modeler are what the license key opens. **SMT007**

BOOK EXCERPT

The Printed Circuit Assembler's Guide to… Design for Test: A Practical Guide to Test and Inspection

by **Bert Horner,** The Test Connection, Inc.

Chapter 5: What Does It All Mean? How to Be Successful



Design for Test is not just a checklist; it's a mindset. It bridges discipline, reduces risk, and drives quality. But to achieve lasting success, it must be embedded into the way teams think, collaborate, and execute. In this chapter, we reflect on the journey so far and provide a roadmap for turning knowledge into action. From best practices and team collaboration to sustaining a test-first culture, this chapter offers practical guidance for organizations ready to elevate their test strategy.

Summary of Best Practices

A consistent set of DFT practices can significantly improve both product quality and test efficiency when applied early and maintained throughout the development cycle. One of the most important steps is to start early by introducing test and inspection considerations during schematic capture and component selection rather than waiting until the layout is complete. This approach helps avoid costly redesigns and ensures that access and coverage are built into the design.

Continue reading…

The Use of BGA Rework Stencils

BY NASH BELL, BEST, INC.

BGA devices provide high I/O density and compact package size, but their hidden solder joints make rework challenging. Successful replacement depends on controlling site preparation, solder deposition, placement, and reflow.

One of the simplest tools in that process is the rework stencil. I view it as a process-control tool rather than simply a way to put paste on a board. Its design affects solder volume, print consistency, and sometimes component alignment.

When Should Solder Paste Be Used?

A question that comes up frequently is whether solder paste should always be printed on the PCB before placing a replacement BGA. At BEST, we do not automatically apply solder paste for every standard BGA placement. For most BGAs with collapsible solder balls, our normal process is to use an appropriate tacky flux and rely on the solder already present on the component to form the joint during reflow. We typically add solder paste when a customer specifically requests it or when there is a clear process reason to do so.

There is not one universal rule requiring paste for every BGA rework. The method depends on the package, land geometry, customer requirements, and qualified process. My preference is not to add another process variable unless it provides a clear benefit; paste printing introduces stencil thickness, aperture size, alignment, and deposit volume as additional variables.

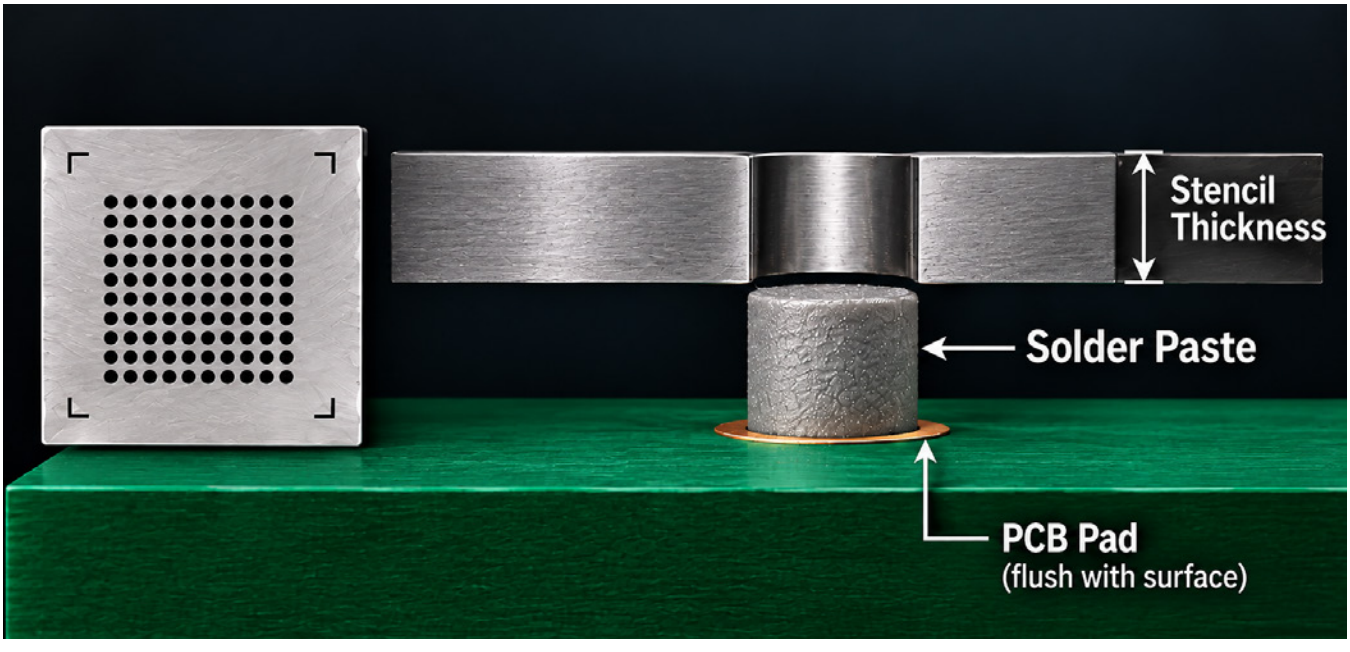


Figure 1: Stencil thickness controls the height of the solder paste deposit, while aperture diameter is generally based on the PCB pad size.



KOH YOUNG TECHNOLOGY

Turn Every Data Point Into a Decision

Go beyond inspection. With AI-driven analytics, Koh Young turns data into insight, helping you predict, optimize, and elevate performance across your factory.

TURN DATA INTO RESULTS

KAP automatically generates inspection programs by recognizing component patterns and validating them against 3D measurement data.

KSMART turns inspection data into real-time insight, improving quality while reducing defects and costs.

SMART REVIEW SMART REVIEW uses AI-powered analysis on an NVIDIA infrastructure to streamline defect verification, reduce false calls, and increase productivity.

KPO Koh Young Process Optimizer, a suite that applies deep learning to enhance surface mount manufacturing.

Measure Everything, AI Everywhere

kohyoungamerica.com america@kohyoung.com

Solder Paste Volume

When solder paste is used, the objective is to deposit a controlled and repeatable volume, not simply to add more solder. Too much paste can increase the risk of solder balls, bridging, or inconsistent collapse, while too little can contribute to insufficient joints. The PCB site should first be prepared so the pads are reasonably flat and free of excessive residual solder.

For standard BGA rework, the stencil aperture diameter will generally be based on the PCB pad size, leaving stencil thickness as the main variable used to control paste volume. A simple rule of thumb is that stencil thickness should be about one-third of the aperture diameter. For example, if the aperture is 12 mils in diameter, a stencil around 4 mils thick is a reasonable starting point. As the aperture diameter gets smaller, the stencil generally needs to become thinner so the paste can release cleanly and consistently.

In practical terms, finer-pitch BGAs with smaller pads usually require thinner stencils, while larger-pitch devices can tolerate thicker stencils. The goal is to provide enough solder volume without making the stencil so thick that paste release becomes inconsistent or the bridging risk increases.

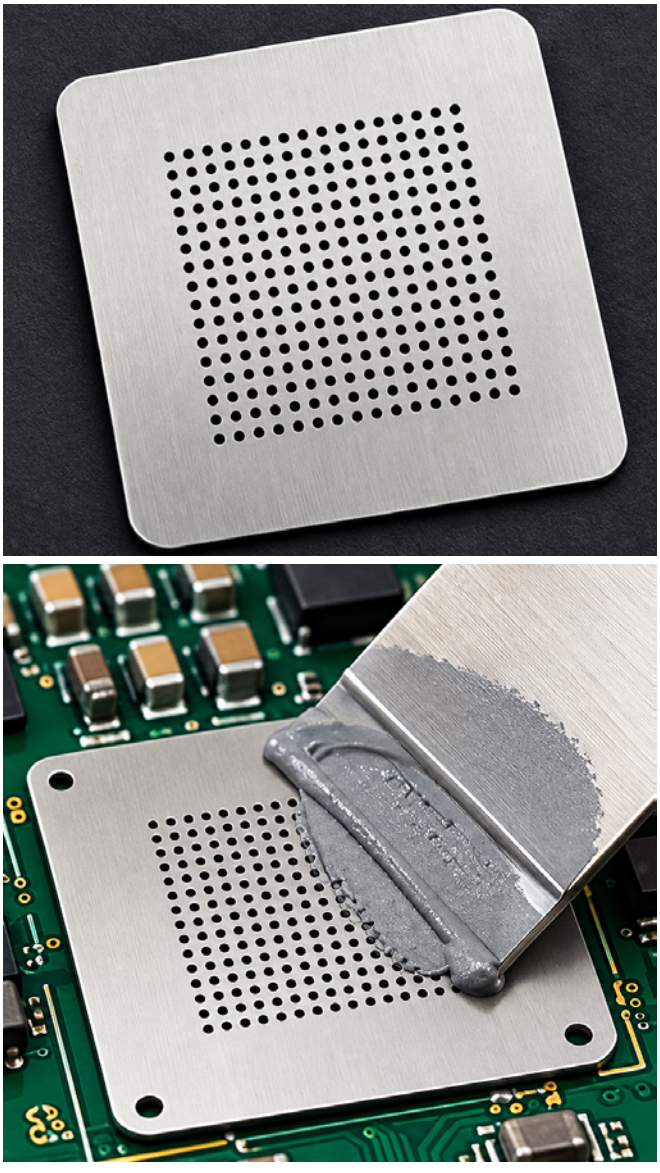


Figure 2: Miniature metal BGA rework stencil used for manual solder paste printing.

BGA Rework Stencils

Three common approaches are miniature metal, removable adhesive-backed, and stay-in-place stencils. Each can produce good results, but they behave differently on a real assembly. The choice usually comes down to access, quantity, pitch, and how much alignment assistance is needed.

Mini Metal Stencils

Miniature metal stencils are common and work well when sufficient access is available around the rework location. Their main advantage is durability: They can be cleaned and reused for repeated rework of the same device.

In practice, however, they require good physical access to the site and consistent contact with the PCB surface. Nearby components can make positioning and printing more difficult on densely populated assemblies. The stencil also needs to sit flat against the board; any distortion, bowing, or uneven contact can affect paste deposition and produce inconsistent volume across the array. Metal stencils work well when there is adequate room and support, but they are not always the most convenient option for tight rework locations.

Removable Stencils

Removable adhesive-backed stencils are the option we use most commonly for standard BGA rework. Because the stencil adheres directly to the PCB surface, it maintains good contact with the board and helps promote consistent solder paste deposition across the array. After printing, the stencil can be peeled away cleanly without leaving adhesive

ARCHER

Expertise for Demanding PCBs

Not every PCB can be manufactured by a single factory

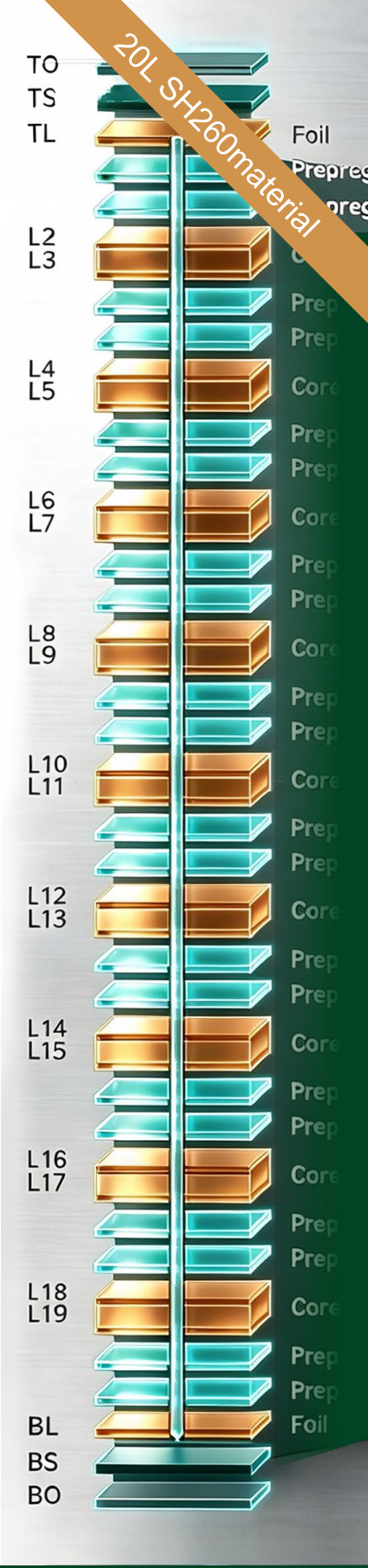
High-layer-count boards, HDI, RF products, backplanes, back-drilling boards and stringent impedance requirements demand far more than just production capacity.

They require specialized engineering know-how, premium materials, robust manufacturing processes and proven industry experience

The experts at Archer Circuits assess your project requirements, resolve manufacturability challenges, and match your design with tailored resources to meet its unique demands

Complex, challenging PCBs are our core strength

- HDI & BURIED COPPER
- HIGH-LAYER COUNT
- HIGH-FREQUENCY
- BACKPLANES
- BACK-DRILLING
- SEMICONDUCTOR & ATE
- DFM & IMPEDANCE
- SIGNAL INTEGRITY SUPPORT



Send Archer your design for a technical review

sales@archercircuits.com

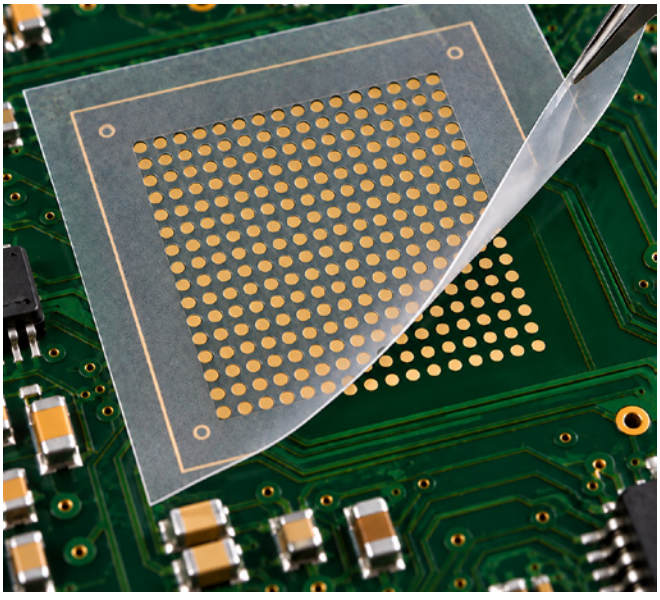


Figure 3: Removable adhesive-backed BGA stencil being peeled from the PCB after printing.

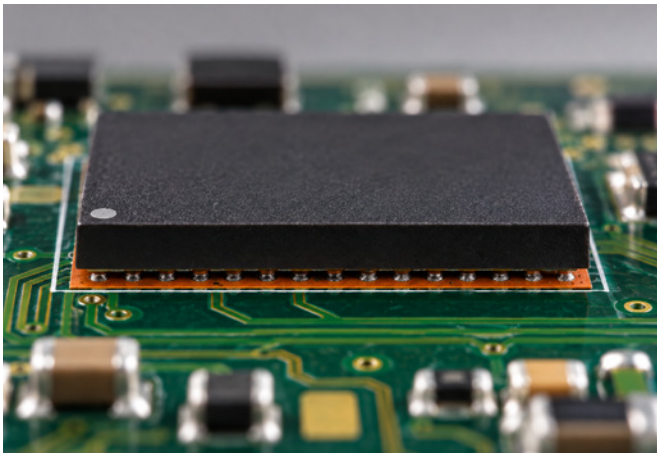


Figure 4: Side view of a BGA installed over an orange stay-in-place stencil, which remains beneath the package after reflow.

residue, and after component placement, there is no visible indication that a stencil was used during the rework process.

Their main limitation is that they are generally intended for single use. Care is also required with very small apertures and fine-pitch arrays. When the stencil is removed, some solder paste can remain attached to the aperture walls and be lifted away from the PCB, reducing the deposited volume. This makes stencil thickness, aperture size, paste release, and removal technique increasingly important as pitch becomes finer.

Stay-in-Place Stencils

Stay-in-place stencils can provide one of the most consistent methods for controlling solder paste deposition during BGA rework. Because the stencil is held firmly against the PCB with a high-temperature adhesive and remains in place through the reflow cycle, it maintains alignment and helps keep the solder paste separated between adjacent pads. This can reduce the likelihood of bridging or shorts during placement and reflow.

Another advantage is that the stencil does not need to be removed after printing, eliminating the risk of disturbing or lifting any paste during stencil removal. The tradeoff is that these stencils are single-use and remain on the assembly after rework. Once the BGA is installed, the stencil can still be visible beneath the edge of the component when viewed from the side. When cosmetic appearance or the absence of visible rework is important, a removable stencil may be preferred.

Conclusion

Stencil selection can have a significant effect on repeatability. Mini metal stencils offer durability and reuse when the site is accessible. Removable stencils are my preferred option for many standard BGA repairs because they sit flush to the board and leave no visible evidence after removal. Stay-in-place stencils provide excellent control of paste deposition and alignment but remain visible beneath the finished component.

The practical lesson is not that one stencil is best for every job. Start by deciding whether solder paste is needed at all. If it is, choose the stencil around the board geometry, pad size, pitch, and the needs of the specific rework. Good BGA rework depends on controlling solder volume, alignment, and heat; the right stencil simply makes those variables easier to manage. **SMT007**



Nash Bell is president of BEST, Inc. To read past columns, click here.

7 FREE COURSES TRANSLATED INTO 5 NEW LANGUAGES.

BUILT FOR ELECTRONICS MANUFACTURING.



More than 3,000 electronics manufacturing companies worldwide rely on our training to build skilled, safety-ready teams. Now that training is even more powerful. As a member, your team gets access to 7 industry-specific courses, now available in English, Spanish, French, German, and Chinese, plus 4 courses newly available in Bahasa Malaysia (Malay). Every course features full native-language narration, not just captions.

COURSE LIST

Newly Spanish, French, German & Chinese:

- Chemical Safety in Electronics Manufacturing
- Introduction to Component Identification for Electronics
- Ergonomics for Electronics Manufacturing
- Introduction to Safety Data Sheets for Electronics Manufacturing

Newly available in Bahasa Malaysia (Malay):

- Safety for Electronics Manufacturing
- Introduction to Component Identification for Electronics
- Foreign Object Debris (FOD) for Electronics Manufacturing
- Electrostatic Discharge (ESD) Control for Electronics Manufacturing

A $385 VALUE PER EMPLOYEE

included with your membership.

Standardize training across every location, in every language your team uses.

Electronics U
by Global Electronics Association

BY JAMES KIM, ARENTFOX SCHIFF LLP

Taking Stock of the New FORCED-LABOR TARIFFS



This month, I'm looking at the new Section 301 "forced labor" tariffs, which are having a sweeping effect on many key inputs into the electronics supply chain. I'll review what the U.S. government is doing to enforce these new tariff measures, including tightening requirements for who can import goods into the country.

If your operation imports a server, bare board, power supply, connector, cable assembly, or finished device, a single purchase order may now be subject to multiple tariff systems before it reaches your warehouse. The same product could be excluded from one tariff, exposed to another, or face detention over its supply chain.

A New Country-based Layer

On July 23, 2026, the Office of the U.S. Trade Representative (USTR) announced final Section 301 actions against 60 economies for failures to impose and effectively enforce prohibitions on forced-labor imports. Duties took effect July 24. According to USTR, those partners accounted for 99.4% of U.S. imports, so this is not a niche program.

Most covered products face 10% when the economy has an import prohibition, a qualifying commitment, or a partial regime, and 12.5% otherwise. For the European Union and Taiwan, the regular most-favored-nation (MFN) duty plus Section 301 is capped, or "topped up," to 10%. The

SUSTAINABLE CONFORMAL COATING—NO COMPROMISE REQUIRED

Yes, you can use actnano materials with Nordson conformal coating systems.

Sustainability initiatives often stall when they threaten line stability. Nordson engineered its conformal coating platforms to run advanced actnano materials using targeted equipment upgrades—not full system replacements.

From circulating fluid delivery to extraction filtration, you can stay in control of coating quality, uptime, and throughput.

- Compatible with ASYMTEK Select Coat® SL-940 and SL-1040 conformal coating systems and valves
- Supports circulation, agitation, and material stability
- Enables transition to safer, sustainable materials without throughput loss

Download the actnano Upgrade Guide
Equipment options, configurations, and part numbers included.

Nordson
Electronics Solutions

ceiling for Japan, Korea, and Switzerland is 12.5%.

The action arrived as the administration attempted to rebuild its tariff architecture after the Supreme Court struck down its previous tariffs issued under the International Emergency Economic Powers Act (IEEPA). Section 301 now functionally recreates part of the broad country-based framework, alongside Section 232 and other authorities.

One distinction to note: These duties respond to economy-wide policies and enforcement. They are not findings that every covered shipment or product was made with forced labor. Section 301 can reach goods unrelated to the investigated practice.

The Scope and Limits to the Electronics Carve Outs

Universal exclusions broadly cover high-purity silicon and silicon carbide; doped semiconductor materials; computers, servers, data-processing units, peripherals, storage, adapters, and related parts; PCAs for automatic data-processing machines; smartphones; network switching and routing equipment; solid-state storage; flat-panel display modules and certain monitors; discrete semiconductors, LEDs, integrated circuits, and related parts; semiconductor fabrication, test, inspection, and metrology equipment and parts; and sintered neodymium-iron-boron magnets. Certain battery waste and scrap are also excluded.

USTR cited limited substitutability for semiconductor tools and insufficient commercially reasonable domestic supply for certain battery waste and scrap. But the operative question remains classification.

The gaps may matter more to assembly operations. There is no broad unrestricted universal exclusion for bare PCBs, capacitors, resistors, most relays, switches, terminal blocks and connectors, general cable assemblies, ordinary transformers and power supplies, or generic printed circuit assemblies. Many of the product exclusions apply only to civil-aircraft goods.

Country schedules add narrower relief. The clearest example of the electronics supply chain is the UK's medical-electronics sector, including diagnostic, monitoring, imaging, and therapeutic equipment, as well as associated PCAs and parts. Several schedules also cover selected glass-fiber fabrics or scrap of gallium, germanium, indium, niobium, or vanadium. Taiwan and Malaysia do not receive broad special exclusions for mainstream electronics.

Section 232 Exclusions and Caveats

Goods actually covered by specified Section 232 "national security" measures, including relevant steel, aluminum, copper and derivatives, vehicles and parts, wood products, and semiconductor articles, are excluded from the new tariffs. Being "actually covered," however, is key.

Under the April 2026 metals framework, many "derivative" products fall outside the metals tariff when covered metal is 15% or less of total weight. Consider a mixed-material control module on a derivative list: If covered metal does not exceed the threshold, it may escape Section 232, but then lose the Section 301 exclusion and pick up the forced-labor tariff unless another exclusion applies.

The bills of materials and weight records are, therefore, critical documentation in determining which tariff applies. Test both sides of the interaction rather than assuming that appearing on a Section 232 list ends the analysis.

The USMCA Opportunity

Canada- or Mexico-origin goods that entered free of duty under USMCA are excluded from the new duties. As I've emphasized in some of my earlier articles, USMCA qualification is an operational tool, not a checkbox.

General Note 11(p) could be an especially useful route for a defined group of IT goods imported from Canada or Mexico. It specifies computers and data-processing machines and units, storage, certain displays, ADP parts, LAN parts, monitor and projector parts, and computer power supplies. The opportunity is classification-specific, does not cover all electronics, and requires a proper USMCA entry. Nonqualifying Canadian or Mexican goods remain exposed absent another exclusion.

The IOR Pressure Point

Along with new tariffs comes enforcement. On June 3, the White House issued an executive order directing tighter importer-of-record (IOR) eligibility, stronger bonding or domestic-asset requirements,

Open the Door to a WORLD of PCB Sourcing Solutions



Our staff can open the doors to Asia-based factory solutions not previously available to your purchasing team. We do this with integrity and transparency, as if we were a trusted member of your PCB sourcing team.

Open the Door and Learn More

Linkage Technologies

info@linkage-tech.com
linkage-tech.com

expanded ownership and supply-chain disclosures, good-standing requirements, a registry and risk tiers, and enhanced vetting.

Under the order, foreign IORs are prohibited from informal entries and generally restricted from using continuous bonds for formal entries. They also need CTPAT validation, if eligible, or a CTPAT-validated licensed broker.

What this means for businesses is that, while DDP terms remain contractually available, foreign sellers may find performance more expensive, more difficult, or more structurally complex. Where DDP terms cannot be used, a U.S. buyer may need to take over IOR obligations, inheriting responsibility for customs clearance and everything that comes with it—classification, valuation, origin, tariffs, recordkeeping, and admissibility—not just a freight invoice.

Tariff Evasion Vs. Optimization

Given all the mounting pressures on landed costs, the temptation to take shortcuts to avoid tariffs can be strong. The government, however, is taking aim at those who evade tariffs unlawfully. Stood up in August 2025, the DOJ-DHS Trade Fraud Task Force recently surpassed $1 billion in civil and criminal recoveries, penalties, forfeitures, and publicly charged losses in under a year. False origin and transshipment, misclassification, undervaluation, shell or nominal IOR structures, free-trade-agreement fraud, and forced-labor violations are in the government's crosshairs.

Next, I'll examine how the government is using the False Claims Act, along with administrative penalties and criminal customs statutes, to target bad actors and tariff evaders. I'll also take a look at the legal and supportable ways to reduce tariff burdens, which are becoming a critical aspect of a broader supply chain and cost optimization strategy for companies in the electronics industry.



Tariff Terminal is a series exploring how trade policy, tariffs, and customs developments impact the electronics manufacturing industry. **James Kim** is an international trade lawyer at ArentFox Schiff LLP.



Accelerate Your Next Assembly with a Total Solutions Provider



The Challenge—

Your assembly line is ready for action.
Can your PCB supplier keep up?

- Tight turn-around time for prototypes
- Increasing board complexity
- Supply-chain pressure

The United Electronics Solution—

We're built for your challenges and offer full-scale PCB services from prototype to production.

- Engineering support
- Prototypes in as little as 1 day
- Up to 20 layers, fine line/space, blind/buried/stacked vias
- Advanced materials including Teflon, polyimide, metal core, RF/microwave substrates
- Metal-backed / thermal-management
- ISO 9001:2015, IPC Class 2 & 3, ITAR Registered, UL certified
- Material stocking, JIT inventory, offshore + domestic production

Ready to elevate your success? Learn more now.

UNITED ELECTRONICS CORPORATION

sales @unitedel.com **847-671-6034** **www.unitedel.com**

BY ALEX SPURGEON, U.S. HEATSTAKE

Designing PCBs for Heat Staking: *The Hole, the Head, and the Copper Around Them*



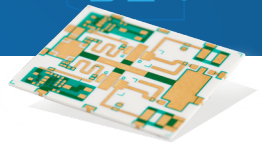
An engineer once sent us a board that had passed every electrical test his team could throw at it: in-circuit test, functional test, and a week of burn-in. Six months into the field, units started coming back with cracked ceramic capacitors and one intermittently open BGA. The schematic and solder were fine. The failure analysis traced it to the assembly step that nobody had questioned: The board was being ultrasonically staked into its housing, and every unit had taken a dose of 20 kHz vibration inches from its most fragile components. High-frequency vibration has its place in assembling plastic components, but next to a ceramic capacitor, it may as well be a paint mixer.

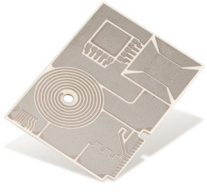
The fix was to move the joint to heat staking—heat and steady pressure on the stud, no vibration—and the returns stopped. Heat staking is one of the most common ways a PCB ends up mounted in a plastic enclosure, and it is routinely the last thing we think about. The mechanical engineer picks the process after the board is released; the manufacturing engineer inherits whatever geometry shipped; and the circuit designer—the one person who could have made the joint reliable for free—usually hears about it for the first time at a failure analysis meeting.

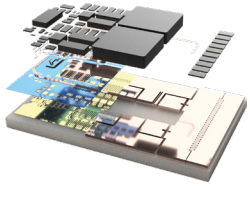
REMTEC®

WHEN PCBs WON'T DO, BE CERTAIN WITH CERAMIC.









Working on a design that exceeds the capabilities of ordinary PCB? Remtec's metallized ceramic substrates, components, and packages may be the solution. Offering superior thermal conductivity, isolation, and dielectric strength – as well as exceptional mechanical stability, environmental robustness, and plenty of versatility and integration opportunities – Remtec ceramic techniques like Direct Bond Copper (DBC), Active Metal Braze (AMB), and Plated Copper on Thick Film (PCTF) are a powerful option for today's high-power, high-density, microelectronic applications. All from a U.S.-based, ITAR-compliant, and OSAT-ready resource with decades of experience.

PCBs not cutting it? Consider the many advantages of ceramic from Remtec.

Visit **remtec.com**, call **781-762-9191**, or email **sales@remtec.com** to initiate a quote.

Visit **Remtec.com**

Registered International Traffic in Arms Regulations ITAR

MADE IN USA MADE IN USA

The Process in 60 Seconds

Heat staking forms a permanent mechanical joint out of material the enclosure already has. A thermoplastic stud, molded as an integral feature of the housing, usually on top of a boss, passes through a clearance hole in the PCB. A heated tool softens the stud and forms it into a head roughly twice the stud's diameter, holding it under pressure while it cools and solidifies. The formed head captures the board, much like a rivet head captures a plate.[1]

Modern equipment runs an impulse cycle: heat, form, and cool under pressure, then retracts with a cooled tip so the plastic releases cleanly rather than sticking or stringing (Figure 1). When done right, the result is a smooth dome that keeps the board flat against its standoffs for the life of the product.

Designers keep choosing it over screws for straightforward reasons: no fastener to purchase, feed, torque, or vibrate loose; no threaded insert; no adhesive and no cure time; and near-zero per-cycle material cost. In vibration-heavy assemblies, such as automotive interiors, appliances, anything that lives near a motor, the absence of a fastener that can back out is the entire point.

The catch is that the joint is only as good as the geometry it was given. A screw forgives a sloppy hole, while a formed plastic head does not.

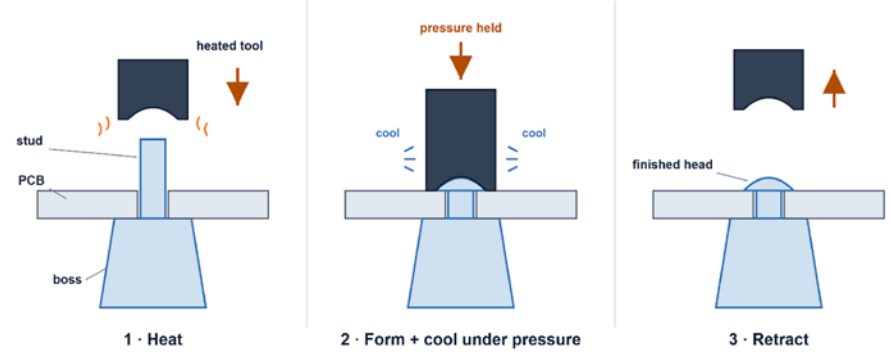


Figure 1: The impulse heat staking cycle. A heated tool softens the thermoplastic stud, forms the head, and holds it under pressure while it cools, then retracts with a cold tip so the plastic releases cleanly.

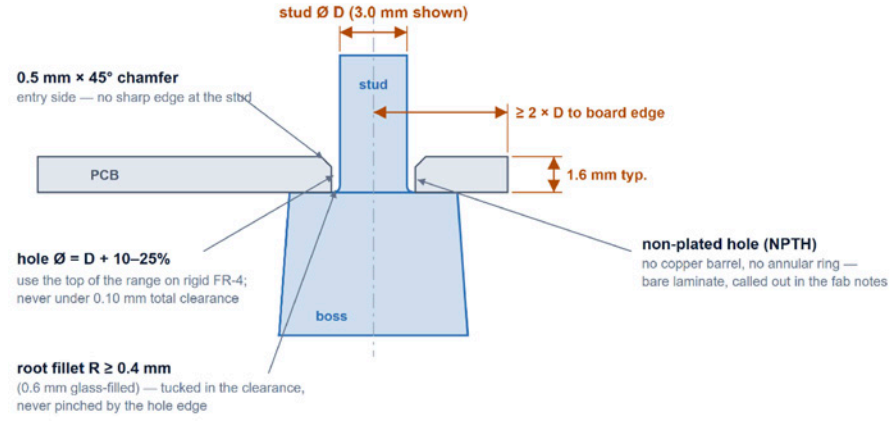


Figure 2: Stake-hole design in cross-section, shown for a 3.0 mm stud in a 1.6 mm FR-4 board. The clearance hole runs at the top of the D + 10–25% range, the entry edge is chamfered, the hole is non-plated, and the stud's root fillet sits in the clearance rather than against the hole edge.

The Hole Is a Design Feature, Not a Formality

Start with the clearance hole, because it is the cheapest thing to get right and the most annoying thing to fix later.

The working rule: Hole diameter equals stud diameter plus 10–25%. For a 3.0 mm stud, the hole is between 3.3–3.75 mm. On a rigid FR-4 board, use the top of that range. A plastic mating part has some give; glass-epoxy laminate has none. If the hole runs tight and the stud runs anywhere off nominal (and a molded stud holds about ±0.05 mm on a good day), the board will either not seat or sit preloaded against the stud before the press ever touches it. Whatever the percentage works out to, never go below 0.10 mm of total diametral clearance.

Two details matter nearly as much as the diameter (Figure 2).

First, the hole edge. A drilled FR-4 hole has a sharp corner, and the root of the stud, where it meets the boss, is the most highly stressed region of the

entire joint. If that sharp edge bears against the root, it acts as a stress concentrator and a cutting tool at the same time. Specify a chamfer or countersink of about 0.5 mm at 45 degrees on the board's entry side, or confirm that the stud's root fillet—0.4 mm minimum, 0.6 mm for glass-filled resins—sits fully below the board rather than inside the hole.

Second, plating. Stake holes should be non-plated (NPTH). A plated barrel adds a hard copper edge against soft plastic and puts a conductor exactly where molten material is about to flow, for no benefit whatsoever. Keep it bare laminate, and make sure the fab notes say so; some fabricators plate everything unless told otherwise.

Position the hole center at least two stud diameters from the board edge, and treat that as a floor, not a target. The same edge-distance rule already applies to the plastic part; the board should not be the weaker half of the pair.

Give the Formed Head Room to Land

The formed head finishes at roughly twice the stud diameter and half the stud diameter tall. The keep-out zone has to be bigger than the head because during forming, softened plastic flows outward, and the forming tool that shapes the head is larger than the head it leaves behind.

A practical rule: Keep everything off a ring of at least 1.5 times the stud diameter, measured as a radius from the hole center, on the top side of the board (Figure 3). For a 3 mm stud, that is a 4.5 mm radius, a 9 mm circle of nothing. Inside it: no traces, vias, test points, fiducials, component bodies, or solder joints. Molten plastic does not read your netlist. A trace that wanders under the head becomes a trace embedded in the joint, and the finished assembly still has to pass acceptance under IPC-A-610[2]; a head that has flowed over a via or pinched a conductor is an easy reject.

The bottom side needs its own keep-out, for a different reason. The board seats on the boss's shoulder or a standoff, and the full clamping load of the joint passes through that annular contact patch. A trace routed through it takes the entire preload across its own thickness, which is a reliable way to manufacture an intermittent. Keep the seating ring bare on the bottom side, sized to the boss outside diameter, which typically runs two to three times the stud diameter.

IPC-2221 and its rigid-board companion IPC-2222 treat mounting and mechanical support as design inputs to be specified on the drawing, not artifacts to be discovered at assembly.[3,4] Stake locations deserve the same treatment as any other mounting hole: dimensioned, keep-outs drawn, and noted.

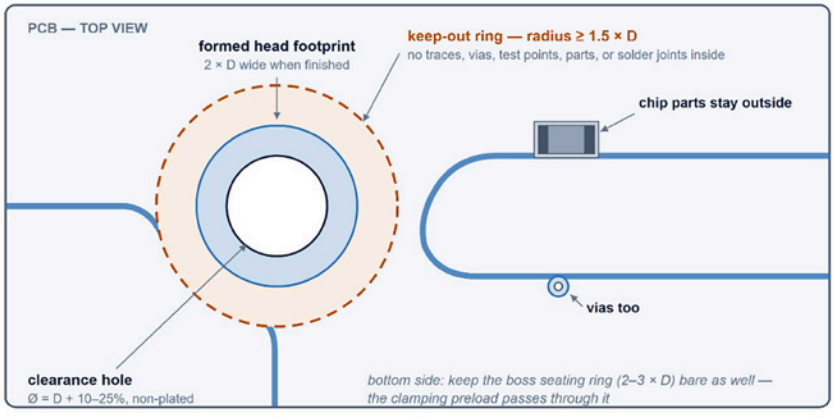


Figure 3: Keep-out zone at a stake site, top view. The formed head finishes at 2 × D; the keep-out ring extends to at least 1.5 × D radius from the hole center, and copper routes around it, never through it.

Half the Job

Get the hole right and keep the copper clear, and you have handled everything about heat staking that lives inside your CAD tool. That is half the job.

The other half happens in about four seconds on an assembly line that you may never visit: A tool comes down, the board takes a load it was never analyzed for, and a little heat lands a few millimeters from your solder joints.

The Board Gets Loaded Like a Structural Part, Because for a Few Seconds It Is One

During staking, the press drives a tool against a stud standing on a boss that holds your board. The load path runs through the laminate. How much load depends on the equipment: displacement-controlled presses form to a programmed height

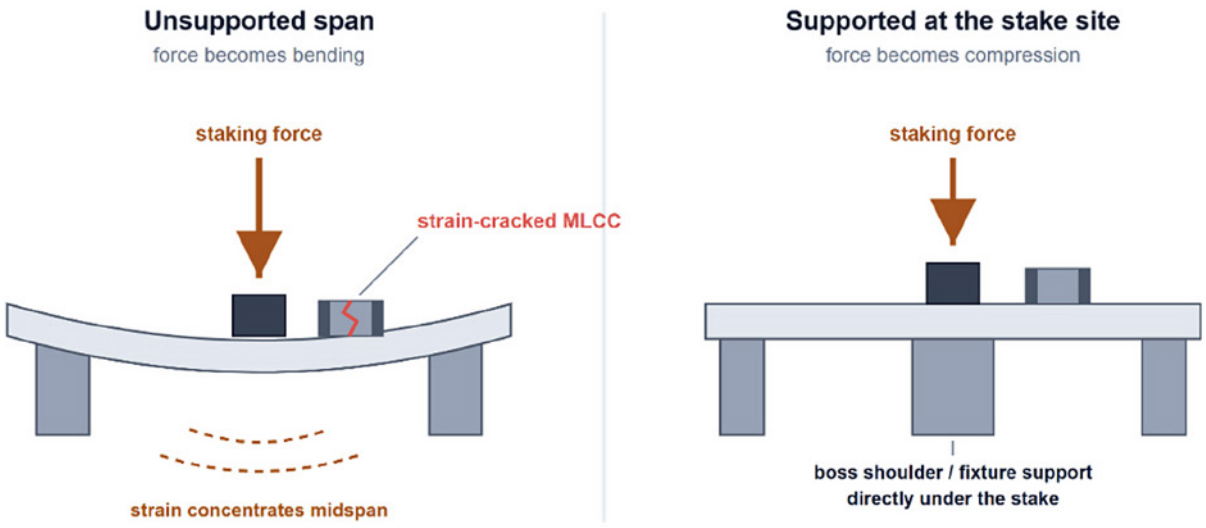


Figure 4: Where staking force goes. Left: An unsupported span turns tool force into board bending, and strain cracks nearby ceramic capacitors. Right: Support directly under the stake site turns the same force into compression, which the laminate tolerates easily.

and stop, cruder force-and-timer setups push until the clock runs out, and the board absorbs whatever the plastic does not.

Board flexure is the failure mode that matters, and its victims are well documented. Multilayer ceramic capacitors crack under board strain, and the cracks are often invisible at test, opening up later in the field under thermal cycling.[5] Pad cratering (fracture in the laminate resin under a BGA pad) follows the same script. Neither failure announces itself at the staking station. Both trace back to strain, which is why IPC/JEDEC-9704A exists to measure it[6] and IPC/JEDEC-9702 exists to characterize how much board-level interconnects can take.[7] Component suppliers commonly cap allowable board strain at a few hundred microstrain; a thin board bridging an unsupported span in a staking fixture can blow through that with room to spare.[8]

The layout defenses are cheap:

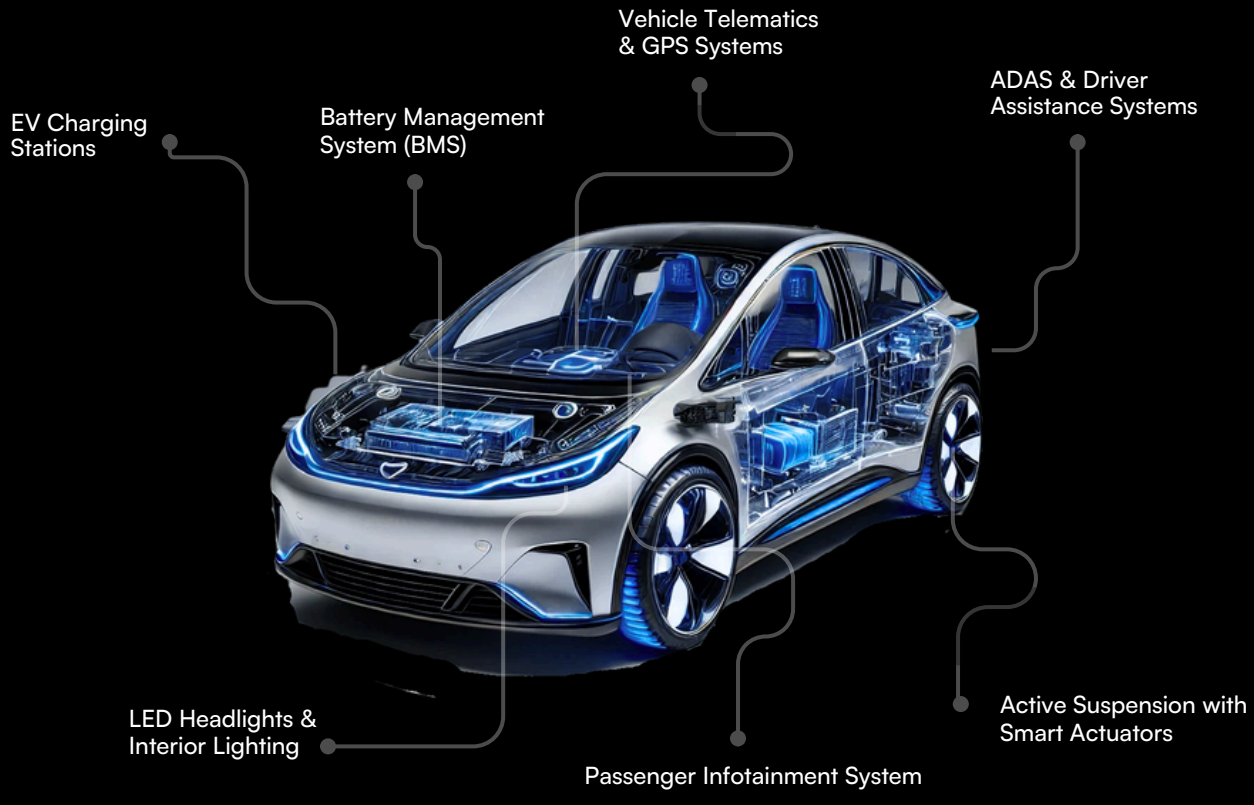
- Treat every stake site the way you already treat screw holes and depaneling edges. Keep large-case MLCCs and BGA corners clear of them, and orient nearby chip capacitors so their long axis runs parallel to the expected bend line rather than across it.
- Ask whether the fixture supports the board near each stake site. The boss shoulder itself is the first support; a fixture that backs up the board directly under the stake turns bending into compression, which FR-4 handles far more gracefully.
- Prefer equipment that forms multiple stakes in one balanced stroke and verifies displacement. A press with position feedback—good systems resolve 0.1 mm—confirms each stud is present and stops the head at the programmed height, cycle after cycle, instead of leaning on the board until a timer expires.

If strain-sensitive components must be within reach of a stake site, indicate this on the assembly drawing and request a strain-gaged first article per IPC/JEDEC-9704A. It is a one-day test that has saved more than one program from a very expensive education.

The Plastic Sets the Temperature, Not the Board

A reasonable worry: The tool runs at 200–320°C, and standard FR-4 has a Tg between roughly 130–180°C.[9] Is the board being cooked?

PCB Solutions for the Road Ahead



Summit Interconnect is the largest privately held PCB manufacturer in North America, delivering high-quality PCB solutions for automotive and commercial applications where performance, reliability, and consistency matter.

With industry certifications across multiple facilities and a broad range of manufacturing capabilities, we provide responsive, customer-focused support for PCBs from quick-turn prototypes through production.

Quote Your Project Today

www.summitinterconnect.com
877-264-0343

Elevate Your PCBs

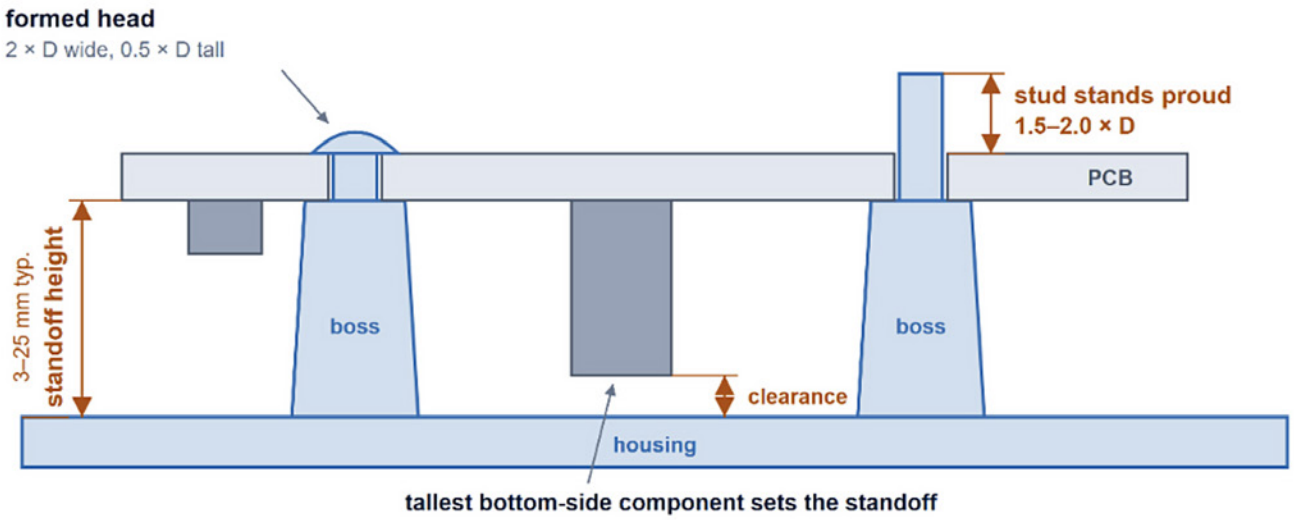


Figure 5: The stackup that crosses the ECAD/MCAD boundary. Standoff height clears the tallest bottom-side component; the stud stands proud of the board by 1.5–2 × D to supply the head's volume. Left stake shown formed, right stake shown before forming.

No, not in a properly run process. The tip temperature is set by the housing resin, not by anything on the board. ABS forms at roughly 200–230°C, polycarbonate at 260–300°C, PA66 at around 280–320°C, with glass-filled grades running about 20°C hotter.[10] The tool touches the stud, the contact is brief, and the board sees warm plastic rather than hot steel. The thermal risk to the laminate and to nearby solder joints becomes real only when the process goes wrong: a tip parked against the board, a missing stud that lets the tool bottom out on laminate, an operator improvising. The keep-out ring is also your thermal insurance, and displacement verification catches the missing-stud case before the tool does.

Board thickness is the designer's other lever. The common 1.6 mm build spreads load well and is the default assumption in most staking geometry. Thinner boards, 1.0 mm and below, flex more under the same force, so the support and placement rules tighten accordingly. Flag board thickness to the mechanical team early; boss and standoff geometry are designed around it, and a late change from 1.6 mm to 1.2 mm quietly invalidates someone's stackup.

One more material note that saves grief: If the housing is glass-filled (30% glass-filled nylon is everywhere in automotive), the stud will not form a clean dome. The fibers do not melt. The usual answers are a hollow stud with a flared profile, or a different retention method entirely. That decision changes the hole size and the keep-out, which is exactly why it needs to happen before layout freeze.

Co-design the Joint, or Redesign the Board

Everything in both parts rolls up into one habit: Put the PCB and the enclosure in the same room before either is finalized.

The stackup makes the case on its own (Figure 5). The boss standoff height has to clear the tallest bottom-side component. Standoffs commonly run from 3 to 25 mm and are sized from the board's bottom-side profile. The stud has to stand proud of the board by 1.5 to 2 times its diameter to supply the head's volume. Hole positions on the board have to match boss positions in the tool within the clearance you specified. Each number crosses the ECAD/MCAD boundary, and each is trivial in co-design and miserable in ECO.

Sometimes the right answer is not to stake at all. Heat staking is permanent; removing a board means drilling off the heads, and it goes back together once, at best, with a screw. If the board needs field service, use screws and inserts. If the housing is a thermoset, staking is off the table; you cannot re-melt a material that cured. If the layout genuinely cannot afford the

Table 1: Seven numbers to bring to the next layout review

Design item	Rule of thumb (D = stud diameter)
Clearance hole	D + 10–25%; top of range for FR-4; never under 0.10 mm total
Hole finish	Non-plated (NPTH), chamfered ~0.5 mm × 45° on the entry side
Board-edge distance	≥ 2 × D from hole center
Top-side keep-out	≥ 1.5 × D radius: no traces, vias, parts, or solder joints
Bottom-side seating ring	Bare laminate over the boss OD (2–3 × D)
Stud protrusion above board	1.5–2.0 × D (head forms 2 × D wide, 0.5 × D tall)
Standoff height	Clears the tallest bottom-side component; ~3–25 mm typical

keep-outs, better to learn that at placement review than at tooling kickoff. A process sold as suitable for everything should be trusted for nothing.

Summary

Heat staking asks very little of a circuit designer, but it asks early. Table 1 is the short version of both parts: seven numbers worth bringing to the next layout review if a plastic housing is anywhere in the product's future.

Get these onto the drawing while the drawing is still cheap to change. The alternative is the meeting mentioned earlier, and nobody enjoys that meeting, least of all the capacitors. **SMT007**



Alex Spurgeon is the owner of U.S. Heatstake.

References

1. *Handbook of Plastics Joining: A Practical Guide*, 2nd ed., by M.J. Troughton, PDL Handbook Series, William Andrew/Elsevier, 2008.
2. IPC-A-610J, *Acceptability of Electronic Assemblies*, IPC, 2024.
3. IPC-2221B, *Generic Standard on Printed Board Design*, IPC.
4. IPC-2222B, *Sectional Design Standard for Rigid Organic Printed Boards*, IPC, 2020.
5. "Flexiterm: Guarding Against Capacitor Crack Failures," Kyocera-AVX, technical paper.
6. IPC/JEDEC-9704A, *Printed Circuit Assembly Strain Gage Test Guideline*, IPC/JEDEC, 2012.
7. IPC/JEDEC-9702, *Monotonic Bend Characterization of Board-Level Interconnects*, IPC/JEDEC.
8. Board Flexure Initiative (BFI) Guide, Intel Corporation.
9. IPC-TM-650, Method 2.4.24C, *Glass Transition Temperature and Z-Axis Thermal Expansion by TMA*, IPC.
10. Polymer Property Database: glass transition and melting temperatures of thermoplastics, Omnexus/SpecialChem.



Find Industry-experienced Candidates at jobConnect007



For just $975, your 200-word, full-column ad will appear in the Career Opportunities section of all three of our monthly magazines, reaching circuit board designers, fabricators, assemblers, OEMs, suppliers and the academic community.

In addition, your ad will:

- be featured in at least one of our newsletters
- appear on our jobConnect007.com board, which is promoted in every newsletter
- appear in our monthly Careers Guide, emailed to 26,000 potential candidates

Potential candidates can click on your ad and submit a resume directly to the email address you provide, or be directed to the URL of your choice.

No long-term contract required. Just send over your copy and company logo and we'll do the rest!

Contact barb@iconnect007.com to get your ad posted today!

+1 916.365.1727

I-Connect007
The Global Electronics Resource

SMT007 PCB007 DESIGN007

CAREER OPPORTUNITIES

schmoll asia pacific

SCHMOLL ASIA PACIFIC — an international machinery company serving the electronics industry (approx. 500 employees in Germany, 300 across Asia, EUR 150m annual revenue) — is expanding in China.

Director of Product Management & Technology – Asia
Guangdong, China | Reporting to the Group CTO

Key Responsibilities:

- Develop and maintain the regional product strategy, technology roadmap, and product lifecycle management
- Monitor competitor technologies and PCB manufacturing trends; prepare market intelligence reports
- Translate customer insights into future product requirements through visits, workshops, and benchmarks
- Lead new product introductions, including launch planning, sales enablement, and pilot installations
- Support regional sales with technical expertise and strategic sales opportunities
- Act as the primary interface between sales, customers, and German R&D

Candidate Profile:

- Degree in Mechanical/Electrical Engineering, Mechatronics, Automation, or related discipline
- 10+ years in PCB equipment manufacturing, preferably drilling/routing; candidates from leading PCB manufacturers are also welcome
- Experience with Via Mechanics, Schmoll, Han's Laser, Tongtai, or similar is preferred
- German speaker
- Strong leadership, strategic thinking, and cross-functional communication; frequent travel within Asia

We Offer:

- A senior position shaping regional product strategy, with close cooperation with German teams
- Competitive package: 13-month salary, performance bonus, 30 days leave, relocation support, apartment, and company car

Apply now and join our international team.

Apply Now!

HT GLOBAL CIRCUITS

Join HT Global Circuits—Build the Future of Advanced PCB Manufacturing

HT Global Circuits is a leading American manufacturer specializing in high-reliability Printed Circuit Board (PCB) fabrication. With domestic facilities in **Milwaukee, WI** and **St. Petersburg, FL,** we deliver mission-critical solutions to the aerospace, defense, medical, automotive, and industrial sectors.

At HTG, we believe our people are our greatest asset. We foster a culture of technical excellence, continuous improvement, and accountability—offering our team the opportunity to work on advanced technologies, solve complex manufacturing challenges, and grow long-term careers within a family-owned business with over 35 years of history.

Open Positions

Milwaukee, WI

- Plant Manager
- Quality Manager
- Quality Engineer
- CAM Engineer
- Maintenance Technician

St. Petersburg, FL

- Quality Engineer
- Process Engineer
- CAM Engineer

How to Apply

Please direct all inquiries and submit your resume to candy.duff@htgpcb.com. Include the position title and preferred location in your subject line.

We look forward to welcoming talented professionals who are passionate about quality, precision, and manufacturing excellence.

Apply Now!

CAREER OPPORTUNITIES

Cogiscan

Solutions Consultant – Americas

We are seeking a Solutions Consultant to provide technical expertise and pre-sales support to customers across North and South America. Working with Account Executives, Account Managers, and partners, you will help electronics manufacturers evaluate how Cogiscan solutions can improve factory connectivity, traceability, material and process control, and operational performance.

You will lead customer discovery, define technical requirements and solution architectures, deliver product demonstrations and technical presentations, and develop Statements of Work, proposals, and project documentation. You will also collaborate with Product Management, Operations, and implementation teams to validate solutions and ensure a smooth sales-to-operations handoff.

What we're looking for:

- 3+ years in Solutions Consulting, Sales Engineering, Applications Engineering, Manufacturing Engineering, or a similar customer-facing technical role
- Experience with electronics manufacturing and MES, traceability, machine connectivity, industrial software, or factory analytics
- Strong communication, presentation, analytical, and problem-solving skills
- Ability to translate customer requirements into practical technical solutions and documentation
- Bachelor's degree in a related technical discipline strongly preferred

This is a primarily remote, customer-facing role requiring approximately 20–30% travel throughout the Americas.

Candidates must be United States citizens due to customer facility access requirements.

Apply Now!

all4-PCB®
NORTH AMERICA

FIELD SERVICE ENGINEER

PCB & Advanced Manufacturing Equipment

all4-PCB is seeking an experienced Field Service Engineer to install, commission, maintain, and support advanced production equipment used in PCB, semiconductor substrate, and high-technology manufacturing.

Equipment includes **direct-imaging systems for solder mask and dry film, AOI/AFI and machine-vision inspection systems, vacuum plasma equipment**, and other automated PCB manufacturing equipment represented by all4-PCB.

The ideal candidate has hands-on experience with industrial automation or capital equipment and strong electrical, mechanical, optical, and software troubleshooting skills. Experience with cameras, lighting, optics, motion control, servo systems, PLC-controlled equipment, vacuum pumps, gas systems, RF power, UV/LED or laser imaging, industrial PCs, and networking is highly valued.

Responsibilities include equipment installation, calibration, preventive maintenance, troubleshooting, process setup, customer training, technical documentation, and coordination with overseas manufacturers.

This position primarily supports customers in the **Texas, California** and requires extensive North American travel, plus occasional travel to Europe and Asia for factory training.

Benefits: Health insurance • Life insurance • 401(k) Paid time off • Ongoing technical training

Apply Now!

CAREER OPPORTUNITIES

Pioneers SYSTEMS

Join Pioneers Systems—Shape the Future of Electronics Manufacturing

Pioneers Systems is a leading Saudi manufacturer specializing in Printed Circuit Board (PCB) fabrication and Printed Circuit Board Assembly (PCBA). Based in Jeddah, Saudi Arabia, we deliver advanced electronic manufacturing solutions to industries including defense, aviation, medical, automotive, industrial, IoT, fintech, and commercial sectors.

At Pioneers Systems, we believe our people are our greatest strength. We foster a culture of innovation, collaboration, continuous improvement, and technical excellence, providing employees with opportunities to work on advanced technologies, solve complex challenges, and grow their careers in a dynamic manufacturing environment.

Open Positions

- Senior PCB Production Manager
- Senior PCB Quality Engineer
- Senior PCB Process Quality Engineer
- Senior PCBA Process Quality Engineer
- Senior Process Engineer – Dry Process
- Senior Process Engineer – Wet Process

How to Apply

Please submit your application through our Career Portal.

We look forward to welcoming talented professionals who are passionate about quality, innovation, and manufacturing excellence.

Apply Now!

PCB RECRUITMENT LTD

FAE Wanted

San Francisco Bay Area, United States

PCB Recruitment Ltd—**the global PCB and electronics industries recruitment specialists**—are working in partnership with our client to source a world-class FAE in the Bay Area.

Outstanding Field Application Engineers in the San Francisco Bay Area – we have an exceptional opportunity that's well worth your attention.

Join one of the world's leading manufacturers of high-performance server PCBs at a pivotal stage of growth.

We're looking for someone with **specialist expertise** in high-speed signal PCBs and experience supporting AI infrastructure, GPUs, 800G–1.6T networking, or similar high-performance computing applications.

Salary: $250,000–$300,000 plus an excellent, industry leading benefits package.

For a confidential, no-obligation conversation, contact william@pcbrecruitment.co.uk.

This opportunity is not to be missed and could be an immense step in your career.

Apply Now!

CAREER OPPORTUNITIES

ARLON ELECTRONIC MATERIALS

Multiple Positions

At Arlon EMD, we support aerospace, defense, and next-gen technology. We're looking for people who show up, take ownership, and get the job done on the production floor and beyond. No fluff. Just real work, real impact, real opportunity.

Now hiring for roles like:

- Field Application Engineer
- Technical Sales Manager
- Maintenance Technician
- Machine Operator
- Customer Service Representative
- Accounting Manager
- Senior Accountant
- Entry-level Sales Engineer

Arlon is a major manufacturer of specialty high performance laminate and prepreg materials for use in a wide variety of PCB (printed circuit board) applications. Arlon specializes in thermoset resin technology including polyimide, high Tg multifunctional epoxy, and low loss thermoset laminate and prepreg systems.

Apply Now!

ventec INTERNATIONAL GROUP

Director – OEM Sales and Business Development
Full-time, USA

Ventec International Group is a global leader in high-performance PCB materials, serving aerospace, defense, AI, automotive, industrial, medical, and high-speed digital markets.

We're seeking an accomplished sales leader to drive OEM business across the United States. This is a business development role focused on winning design-ins, building executive relationships, and securing long-term strategic partnerships with leading electronics companies.

Key Responsibilities

- Win new OEM opportunities across Ventec's product portfolio
- Develop relationships with OEMs, PCB manufacturers, and technology partners
- Drive specification wins in advanced electronics applications
- Lead and develop our manufacturer representative network
- Partner with technical teams to deliver customer solutions
- Contribute to commercial strategy, forecasting, and market intelligence

About You
You have at least five years' experience selling to OEMs within the electronics or PCB industry, with a proven record of winning new business and delivering sustained growth. You're commercially driven, confident engaging senior decision-makers, skilled at solution selling, and able to understand technical products while working independently and within global teams.

Why Ventec?
You'll work alongside senior leadership, influence major global programmes, and help shape the future of advanced electronics while making a direct commercial impact.

Apply Now!

CAREER OPPORTUNITIES

REMTEC®

Senior Thick Film & Microelectronics Quality Engineer

Remtec is growing and has an exciting opportunity at our dynamic, team-oriented tech-manufacturing company, based in our newly renovated headquarters in Canton, MA, just south of Boston.

The Senior Thick Film & Microelectronics Quality Engineer ensures product quality and AS9100 compliance across thick film fabrication and microelectronics assembly, including printing, firing, laser trimming, plating, wire bonding, soldering, assembly, testing, and inspection.

Responsibilities include:

- managing nonconforming materials
- leading root cause investigations
- conducting audits
- developing control plans, PFMEAs, and inspection procedures to ensure customer and regulatory requirements are met

The role partners with production and suppliers to establish quality standards and improve supplier performance and yield, reduce waste, and support continuous improvement overall.

The ideal candidate has a bachelor's degree in engineering or a related technical discipline, at least three years of quality engineering experience in microelectronics, semiconductor, or PCB manufacturing, and hands-on knowledge of thick film processes, quality systems, and problem-solving.

Preferred skills include AS9100/ISO 9001 systems; nickel, gold, and silver plating and surface finishes; GEA and MIL testing and inspection standards; and statistical software.

Join Remtec and contribute to a collaborative culture focused on quality, integrity, and innovation. Learn more and apply here:

Apply Now!

TECHNICA, U.S.A.

Various Positions

For 40 years, Technica USA has been providing products, equipment, and services to the printed circuit board fabrication and assembly markets. Working with our worldwide partners, we offer our customers solutions through best-in-class product lines. Technica has offices in San Jose, Calif, and Rancho Cucamonga, Calif.

We are expanding and looking for highly qualified Business Development/ Account Managers for both the PCB and PCBA markets.

We are adding to our growing national equipment service coverage and looking for experienced Equipment Service Technician/Engineers.

Are you a PCBA equipment applications expert with experience in component placement and inspection? We are looking for Equipment Product Specialists to work within our San Jose, Calif., PCBA Equipment Demo center.

Please visit www.technica.com/careers to learn more about these positions and submit your resume today!

Apply Now!

CAREER OPPORTUNITIES

eptac
TRAIN. WORK SMARTER. SUCCEED.

Instructor – Electronics Manufacturing

EPTAC is seeking experienced professionals from the electronics manufacturing industry to join us as Instructors. This role offers flexible part-time or full-time opportunities. Ideal candidates will have expertise in soldering, quality control, PCB design, or related fields.

Responsibilities:

- Teach IPC Certification and electronics manufacturing related courses
- Travel as needed to teach at EPTAC locations or customer sites across the U.S.
- Contribute to the development of new training programs and enhance existing courses
- Stay current with industry trends, emerging technologies, and best practices to refine instructional techniques
- Provide hands-on demonstrations and supervise use of industry tools
- Foster a positive learning environment, enforcing classroom and safety rules

Requirements:

- 10+ years experience in the electronics manufacturing industry
- Current or past IPC Certification
- Bachelor's degree or equivalent
- Excellent communication, instructional, and organizational skills
- Practical, quick, and hands-on approach to problems
- Unrelenting drive to understand and meet student needs

EPTAC is the leader in Electronics Manufacturing Training and Certification in North America with 24 locations. Our headquarters is in Salem, NH. We offer a modern, positive environment with benefits including health care, paid time off, retirement savings, and professional development.

Email careers@eptac.com to apply.

Apply Now!

PK M·E·T·A·L

Independent Sales Representatives Wanted

P. Kay Metal / MS2 Technologies, headquartered in the United States, is seeking established **independent sales representative firms** to add a proven, patented product to their portfolio.

We manufacture and supply **MS2® Molten Solder Surfactant,** a patented solution designed for both **Tin/Lead and Lead-Free soldering processes,** delivering measurable performance and cost benefits to electronics manufacturers.

MS2® already has successful customer installations throughout the United States, as well as a growing international footprint with active customers in Mexico, El Salvador, Honduras, Ecuador, and the Dominican Republic. We ship globally and support customers worldwide.

This opportunity is ideal for rep firms currently calling on electronics manufacturing, PCB assembly, soldering, or process engineering accounts who are looking to expand their offering with a differentiated, high-value consumable.

Strong technical products, international growth potential, and factory support provided.

To learn more about our company and technology, visit **www.pkaymetal.com**.

Interested firms are encouraged to reach out for additional details to Gladys Flores at gladysflores@pkaymetal.com.

Apply Now!

CAREER OPPORTUNITIES

ACE
ACCURATE CIRCUIT ENGINEERING

Quality Assurance Specialist—Bare Board PCB Manufacturing

Accurate Circuit Engineering seeks an organized, technically proficient Quality Assurance Specialist dedicated to bare board PCB production. You will champion compliance with industry standards, lead internal audits, manage certifications, and drive continuous improvement based on product performance data and customer feedback.

Key Responsibilities:

- **Standards Compliance & Certification:** Enforce IPCA600, IPC6012 (CIS/CIT preferred), and ISO 9001 quality standards throughout fabrication
- **Internal Process Auditing:** Conduct scheduled and ad hoc audits of incoming materials, fabrication stages, testing protocols (etest, AOI), and documentation traceability
- **Employee Training & Development:** Create and deliver training programs for inspectors and production staff on IPC standards, quality procedures, and inspection tools to maintain certification
- **Failure Analysis & Corrective Actions:** Investigate nonconforming boards—including internal findings and customer returns/RMAs—analyze root causes, and lead corrective/preventive actions (8D/CAPA)
- **Procedure Optimization:** Analyze quality trends and RMA data to update processes, inspection checklists, and control plans

Qualifications:

- Associate degree or equivalent experience in electronics manufacturing
- 3+ years in bare board PCB QA, with IPCA600/CIS and IPC6012 certification
- Strong auditing, training, documentation, and cross-functional collaboration skills
- Proficient in rootcause failure analysis

Join us to ensure rigorous compliance, elevate fabrication quality, and continuously improve manufacturing standards.

Contact brandon@ace-pcb.com and James@ace-pcb.com to apply.

Apply Now!

INSULECTRO

Are You Our Next Superstar?!

Insulectro, the largest national distributor of printed circuit board materials, is looking to add superstars to our dynamic technical and sales teams. We are always looking for good talent to enhance our service level to our customers and drive our purpose to enable our customers to build better boards faster. Our nationwide network provides many opportunities for a rewarding career within our company.

We are looking for talent with solid background in the PCB or PE industry and proven sales experience with a drive and attitude that match our company culture. This is a great opportunity to join an industry leader in the PCB and PE world and work with a terrific team driven to be vital in the design and manufacture of future circuits.

Apply Now!

I-Connect007
The Global Electronics Resource

EDUCATIONAL RESOURCES



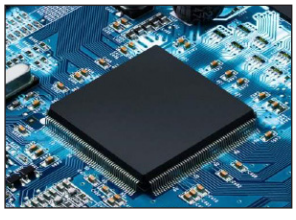
BOOKS

Companion Guide Now Available!

The author of *The Printed Circuit Assembler's Guide to Factory Analytics* returns with updated insights and practical information in a convenient, downloadable companion guide.

VIEW BOOK

WHITE PAPERS

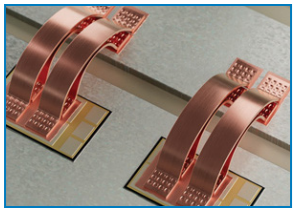


Salvaging Electronic Components

by Best, Inc.

DOWNLOAD

Examines electronic component salvaging as a practical strategy for reducing e-waste, conserving rare-earth materials, lowering semiconductor manufacturing energy demands, and addressing supply-chain shortages.



Enabling Next-Generation Die Topside Interconnection

By MacDermid Alpha Electronics Solutions

DOWNLOAD

Introduces ALPHA® Argomax® BondPad, a next-generation sinter-ready copper foil solution for advanced semiconductor die topside interconnection.

PODCASTS



Meet the Author: The Printed Circuit Assembler's Guide to… Design for Test

with Bert Horner, The Test Connection, Inc.

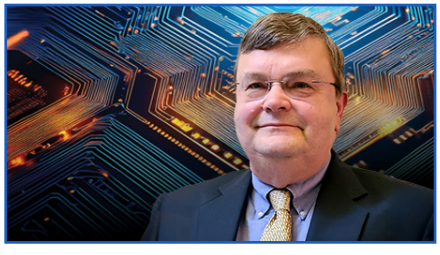
LISTEN NOW >



Voices of the Industry

with Kelly Davidson, NCAB

LISTEN NOW >



On the Line with… American Standard Circuits: Ultra HDI

with John Johnson, American Standard Circuits

LISTEN NOW >

I-Connect007
The Global Electronics Resource

Executive Director
MARCY LARONT
marcy@iconnect007.com • (480) 280-5229

Managing Editor
NOLAN JOHNSON
nolan@iconnect007.com

Associate Editor
MICHELLE TE
michelle@iconnect007.com

Technical Editor
PATTY GOLDMAN

Contributing Technical Editor
HAPPY HOLDEN
happy@iconnect007.com

Business Development Manager
BARB HOCKADAY
barb@iconnect007.com

Marketing Services Manager
TOBEY MARSICOVETERE
tobey@iconnect007.com

Digital Marketing Manager
BRITTANY MARTIN
brittany@iconnect007.com

Art Director | Production Manager
SHELLY STEIN

Magazine Layout
MICHAEL DEL PURGATORIO

Ad Design
TOBEY MARSICOVETERE

Director of Digital Operations
and Media Systems
BRYSON MATTIES

Cover Design
MICHELLE TE

Cover Image
OPENAI CHATGPT

SMT007 MAGAZINE®
is published by IPC Publishing Group, Inc.,
3000 Lakeside Dr., Suite 105N, Bannockburn, IL 60015

© 2026 IPC Publishing Group, Inc. does not assume and hereby disclaims any liability to any person for loss or damage caused by errors or omissions in the material contained within this publication, regardless of whether such errors or omissions are caused accidentally, from negligence, or any other cause.

November 2026, Volume 42, Number 11
SMT007 MAGAZINE is published monthly,
by IPC Publishing Group, Inc., dba I-Connect007.

ADVERTISER INDEX

Akrometrix 23
American Standard/ASC Sunstone 27
Archer Circuits 47
Blackfox Training Institute 39
CETEC ERP 7
DYMAX 33
EPTAC 15
Flexible Circuit Technologies 41
FSQuality 9
Global Electronics Association 29, 49
GreenSource Fabrication 35
I-007eBooks 2, 37
Indium 11
Koh Young Technology 45
Linkage Technologies 53
Nordson 51
Omega EMS 17
On the Line with... 3
P Kay Metal 21
Photonics 19
Remtec 57
Summit Interconnect 61
Technica USA 5
U.S. Circuit 31
United Electronics 55

SMT007 MAGAZINE

Problems solved!

