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# SMT

AN I CONNECT007 PUBLICATION

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Printing and Assembly Challenges for QFN Devices p.48

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APRIL 2011



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## IPC APEX EXPO — *We've Got Talent*

### Welcome to the April 2011 issue of **SMT Magazine**

It's April, and that means one thing:

#### **Show time!**

Many of you will be attending IPC APEX EXPO 2011, our industry's biggest North American show, April 10-14 at Mandalay Bay Resort & Convention Center in Las Vegas. The editors at **SMT** will be bringing you all the information you need to know, before and after the show.

This issue features the **IPC APEX EXPO New Product Showcase 2011**. In addition to highlighting the new tools, equipment and materials being shown at APEX, we also point out the most exciting of these new products.

The **New Vision Awards** surveys were sent out earlier this year, and the results continue to come in. In this issue, we discuss the wide range of feedback we've received and provide a few observations and interpretations of this critical data.

Carrying on the trade show theme, we continue our coverage of **"Reacting to the Age of the Domain Expert: Industry Collaboration to Make Prototyping Easier, Part 2,"** a panel discussion held at Design-Con 2011. Read all about how these compa-

nies from different parts of the supply chain decided to work together to leverage each other's core competencies.

Ray Rasmussen is still worried about our industry's longevity. His column **"Prophet of Doom, Again!"** discusses a new book by physicist Michio Kaku that lays out the case for the possible end of Moore's Law. Have we really hit the wall for transistor density, and if so, what will it mean for technology?

And in this issue, we feature a group of Technology in Focus articles, from authors **Vern Solberg** of Solberg Technical Consulting, **William E. Coleman** of Photo Stencil, **Jean-Cyril Walker** of Keller and Heckman LLP, **Harold Katz** of Syspro USA, and Indium's **Ed Briggs and Ron Lasky**.

As it says on the cover of this blockbuster issue, "We've got talent." We'll all be at IPC APEX EXPO from start to finish, covering the show with our Real Time with...IPC video program. We'd like to hear from you, so don't forget to stop by Booth 1621. Remember to catch all the action during and after the show at [www.realtimewith.com](http://www.realtimewith.com).

***See you at the show!***

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# Prophet of Doom, Again!

by Ray Rasmussen  
I-CONNECT007

I guess you could say I'm sort of the Prophet of Doom these days. I seem to be talking about the [end of the PCB](#) as we know it; or the emergence of [printed electronics](#) and how it's going to hand us our lunch; or how Apple and others are working to drive the PCB out of existence with the iPhone, iPad, etc. All of these things are real (at least to me) and either happening today or will be, very soon. But this next piece takes the cake. Oh, my.

*By around 2020, the age of the ever-smaller chip will come to an end, and we'd better prepare for it.*

Renowned physicist [Michio Kaku](#) has written a book [The Physics of the Future](#). I ran into an excerpt from the book in [Salon](#), which took my angst about the demise of the PCB up a couple of notches.

Kaku points to the end of [Moore's Law](#), which has, for the last 45 years or so, seemed unstoppable. Moore's Law is the foundation for all that we do; it's what drives the industry and keeps the cycle of more and better electronics rolling.

Lots of smart folks have forecast its demise only to be blown out of the water by the next microprocessor iteration. There has always been a solution to the next barrier which allows the Law to push through them all.

The problem is, although we may like to stay on this trajectory forever, the physics



won't allow it. Unless we can change the laws of physics, Moore's Law will run out of gas in about 10 years. And when it does, what's going to happen? Here's a quote from the book:

*So the collapse of Moore's Law is a matter of international importance, with trillions of dollars at stake. But precisely how it will end, and what will replace it, depends on the laws of physics. The answers to these physics questions will eventually rock the economic structure of capitalism.*

I love guys who think like this. On the one hand, it's frightening to hear what they have to say. Kaku isn't some "futurist" spouting a theory based on some far-out thinking; he's talking about a fundamental law of nature and his comments are widely accepted within the scientific community. It's really going to happen, and soon.

On the other hand, it's really exciting.

I do tend to point out the scary side of things in my articles, since it's a great way to get people's attention. In this case, I do believe there's a tremendous upside for society as we leave older, limiting technologies like silicon and replace them with something much more capable and powerful that will lay the foundation for the future. Of course, the end of silicon and the rise of some new technology won't happen overnight. Meanwhile, there will

## IN SUMMARY

Physicist Michio Kaku has written a book, *The Physics of the Future*, which takes my angst about the demise of the PCB up a couple of notches. Kaku forecasts the demise of Moore's Law and says how it will end, and what will replace it, depends on the laws of physics. The answers to these physics questions will eventually rock the economic structure of capitalism.

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be the need for newer and better products for years to come, hopefully. Read on.

Kaku also suggests that even if Moore's Law lasts well into the future, we will reach a point very soon when hardware upgrades won't be needed. Other than the size of the hard drive, my three-year old Macbook Pro will likely continue to serve me well for the next three to five years, if I don't drop it too many times. It's plenty fast and easily does what I need it to do, mostly word processing and emailing. My next one will likely last longer and have the computing power of today's super computers. And, with everything going to the Cloud, all we'll need is Internet access in most cases. Think of what Apple is doing with its iPhones and iPads. Most of the capabilities of these things reside in the cloud or in the apps (which more and more rely on the cloud for their functionality).

A couple more iterations of the hardware along with 4G or 5G Internet access speeds and most of us will be done, focusing more

on apps not the hardware. Even the storage issue I've run into with my Mac today will be (and can be today) solved by the Cloud. So, whole categories of products may reach their limit simply because Moore's Law works too well, and, unless something much more revolutionary comes along, most of us will be content to use the tools we have. The doubling of processor speeds, even if it were technically possible, wouldn't be necessary for most products.

During discussions about this article with a few close industry friends, they mentioned that rumblings of this issue are starting to come out of companies like Intel and the like. The science is pretty clear: There are limits. Things are about to change.

So, [here's the excerpt](#). Read at your own peril. It may lead to many sleepless nights.

Now, where does this leave us? What do we do? As I mentioned above, electronic products will continue to improve and innovators and their innovations will always be with us. Combine this with globalization and the need to bring billions more people clean water, food, electricity, communications, education, healthcare and more, and I believe you can see that we have a way to go before we reach saturation.

We still have lots more products to build. And regarding Moore's Law, hopefully in 10 to 20 years we'll begin to see some new technology take over once the silicon chips limit out, which will be mostly used in very high-end systems driving the Cloud, I would guess.

Do I need a super computer in my hand? I don't think so. I may need one to run my personal robot, though. We'll see. **SMT**



Ray Rasmussen is the publisher and chief editor for I-Connect007 publications. He has worked in the industry since 1978 and is the former publisher and chief editor of *CircuiTree Magazine*. Ray can be contacted at: [ray@iconnect007.com](mailto:ray@iconnect007.com)





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# New Vision Awards: *A Few Results*

by **SMT Magazine Staff**

## IN SUMMARY

The businesses we want to recognize and reward are our suppliers. The suppliers that continually push the envelope with new technologies, products and services are a major driving force behind the success of PCB fabricators, electronic assemblers and PCB designers.

Before any product is designed, manufactured, assembled and put on the market, a light bulb (an eco-friendly LED light, naturally) goes on when an idea forms. As that light glows, the idea morphs into a vision, an idealistic view of the idea's future. The transformation of an idea into a vision is an integral part of the creative processes that have kept I-Connect007 focused on our readers

and dedicated to breaking new ground as our industry grows and evolves.

The ideas that we decide to develop and pursue are always based on our mission, which is to:

- consolidate industry information,
- expand readers' knowledge,
- improve businesses, and
- foster communication throughout the global electronics supply chain.

Nothing captures our mission more perfectly than the New Vision Awards, which, like every new product or process, started with the glow of a new idea.

We have watched awards programs come and go through the years, but never really saw them impact the way our industry does business or help businesses be more successful. Award programs of the past were the annual, predictable pats on the back, nominated and voted on by the very people who are ultimately eligible to receive the awards. So our first decision was to:



*We have watched awards programs come and go through the years, but never really saw them impact the way our industry does business or help businesses be more successful.*



### Let Users Choose the Winners

The businesses we want to recognize and reward are our suppliers. The suppliers that continually push the envelope with new technologies, products and services are a major driving force behind the success of PCB fabricators, electronic assemblers and PCB designers. It wouldn't make sense for those suppliers to nominate and vote for each other. The truest evaluation of our suppliers must come from the users—the fabricators, assemblers and designers who benefit from supplier excellence, game-changing development and products that transition from idea to implementation and make our industry better.

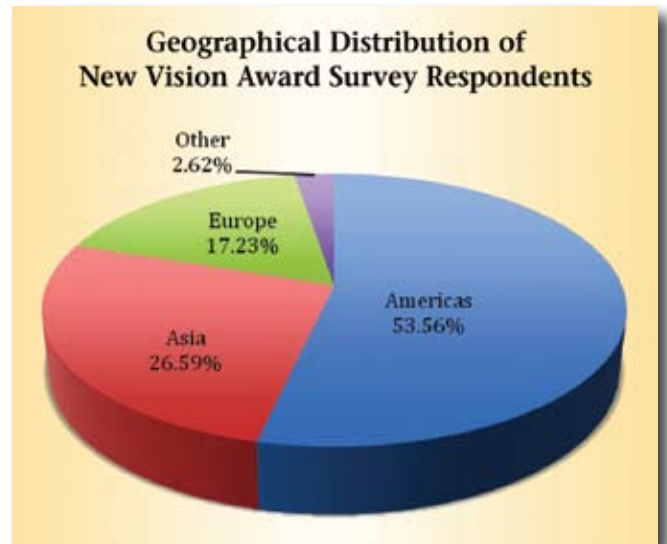
Where do we find these users? How do we contact them? What will motivate them to participate in deciding the first recipients of the New Vision Awards? These questions and so many more were discussed and debated amongst our team at I-Connect007 and with key advisors with vast experience, hands-on experience and the respect of their peers in the industry.

In addition to recognizing and rewarding suppliers, the New Vision Award team wanted to reward users for taking the time to complete the survey. Knowing that some of the information resulting from the survey would give our users a competitive advantage as they evaluate suppliers, technology and products, we decided to entice our users to vote by offering them exclusive, advance access to the survey data.

Once most of the decisions were made and the processes decided upon, we held our breath as a button click sent several thousand e-mails out to the users we wanted to reach. The response we have received is remarkable, illustrating the global reaches of our industry and reminding us that the users would not only possess a wealth of information about their suppliers, but would also have things to tell us about the New Vision Awards.

From that one button click in California came responses from around the globe. Our kernel of an idea had evolved into the New Vision Awards and our request for input from users was now flying effortlessly across time

zones, oceans, mountains and borders. And as quickly as we sent the e-mail we started hearing from our target audience...USERS!



Now that we were getting responses from around the world, what were they telling us?

### What do Users Want from Suppliers?

As we developed the survey that users would complete to vote for the New Vision Awards, we knew we didn't just want votes. We wanted information that users and suppliers alike would value. And as the surveys continue to roll in, we are getting more and more detailed, valuable information. Since we are still collecting votes, we can't tell you what companies or products are leading the pack, but we can give you a preview of the type of detailed analysis that will be a valuable result of the New Vision Awards survey.

One key issue that we ask about in the New Vision Awards survey is how users rank the following various attributes of a product in terms of importance:

- Ease of Use
- Efficiency
- Quality
- Supplier Support
- Value

We use a "force ranking" question because we know that if the person is voting for a certain product, he/she would naturally

give all of these attributes high ratings. But we aren't looking for this question to help determine the winner, but to provide a more detailed analysis of WHY that particular product was selected.

We expected that we would find trends in the rankings, but we were surprised at the variation in results between the various industries: PCB fabrication, electronic assembly and design. We looked at the attributes that were ranked first or second in importance and found that analyzing the data was enhanced by having a visual image of the results. Here is what we found (see graphs below).

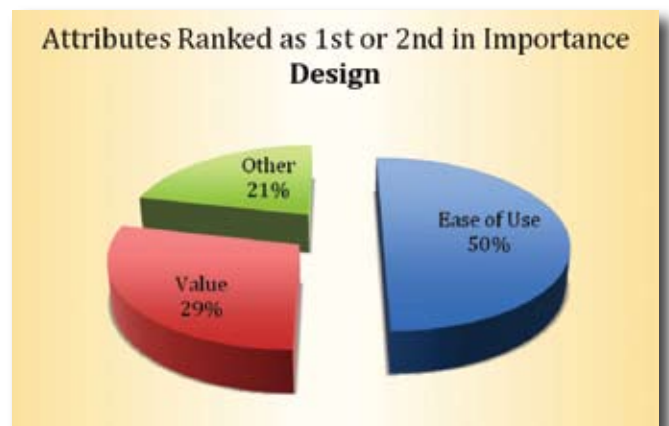
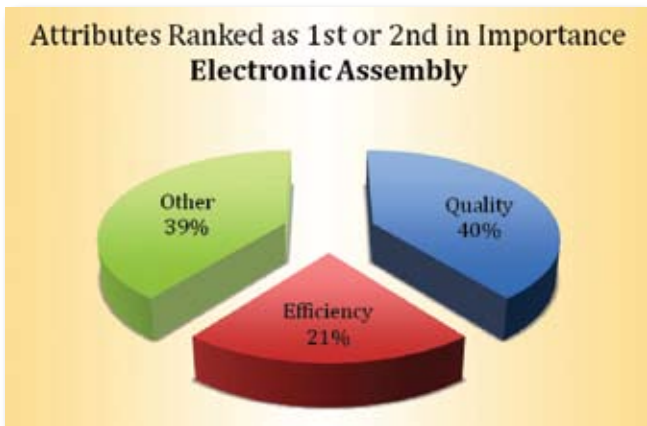
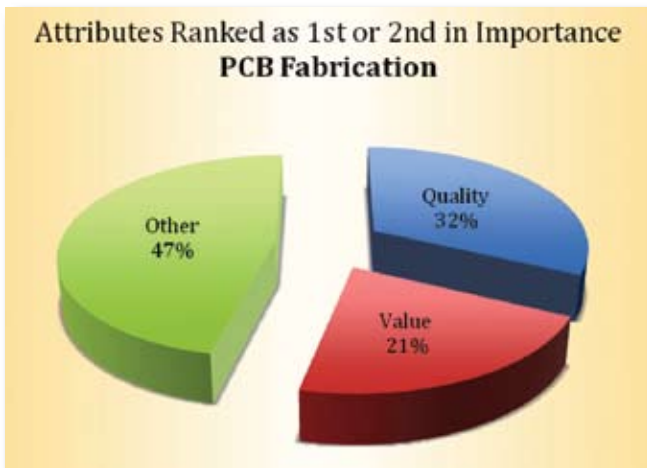
While quality is clearly the most important issue to PCB fabrication and electronic assembly, it doesn't make the top two when it comes to design. And while PCB fabrication and electronic assembly share an emphasis on quality, they are split, with PCB fabrication's second most important attribute being value

and electronic assembly's being efficiency. Design suppliers should sit up and take notice that ease of use is clearly a major factor, followed by value.

An awareness of these trends is valuable, but now that we know the priorities of the various segments of our industry, we are on track to providing a deeper level of analysis. Why are these certain factors more important than others? If these factors are so important, how can users measure these attributes when evaluating a new product? Knowing the importance of various attributes, can suppliers improve their processes to ensure that their products meet the users' expectations in their most important areas?

We don't claim to have all the answers, YET! But as the layers of information from the survey unfold, we are impressed not only by the data it provides, but by the many additional questions it raises. What changes may take place as a result of having solid data on seemingly subjective issues? Can our industry experts help us dig deeper to learn more about why certain products were ranked as they were? We at I-Connect007 do to disseminate key discoveries throughout the industry, and get users talking with their suppliers (em dash) and each other (em dash) about utilizing this information? How do we help companies use this knowledge to improve their processes and remain profitable in a rapidly changing environment?

We hope this little teaser about the



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survey results will get you thinking and talking with others about the New Vision Awards and their benefit to your business. Users' feedback indicates that many need more time to consider the suppliers and products they want to vote for, so we have responded by making the deadline for completing the survey open-ended. We figure that the more input we get from users, the more data we will have to share. If you haven't completed the New Vision Awards Survey yet, please get the process started today by clicking [here](#). We also hope that you will tell your friends about the New Vision Awards or sign them up [here](#).

We're waiting to hear from you! **SMT**

## APEX to Highlight Small Product Testing

The ongoing evolution of electronics forces companies to constantly update their processes. As semiconductor geometries shrink, manufacturing and test specialists at all levels must respond to maintain quality and reliability of smaller and smaller systems.

"In the 1990s, measurements in the 100s of microns were enough," said Bongtae Han, Division Leader of Electronic Products & Systems Division and Director of Laboratory for Optomechanics and Micro/Nano Semiconductor/Photonics Systems at the University of Maryland. "Now many testing specialists need to measure in terms of microns or even sub microns."

The professor, who is also affiliated with the university's Center for Advanced Life Cycle Engineering (CALCE), has developed various methodologies for measuring small amounts of warpage and to determine how this bending impacts the small packages.

Han notes that warpage can occur at different times. Many times, people ask

whether smaller warpage at the reflow temperature makes for better reliability in the field. Often, it doesn't.

"The smaller warpage at the reflow temperature could cause more warpage at room temperature and the yield problem can be shifted to the board-level reliability problem. That's especially true with package-on-package (PoP) products," Han said.

Accurate warpage measurement will lead to package designs with optimum reliability; the optimum has become a dynamic target as it changes with application-specific designs.

Han will also examine the positive and negative traits of existing test methodologies and technologies during IPC APEX EXPO. As part of the Professional Development courses, Han will present a three-hour course titled *PD-13, Warpage and Coplanarity Measurement in the Assembly Process: Current Methods* on Sunday afternoon, April 10, 2011. Separate registration is required.

## Here's what one of our customers had to say about Prototron...



As a design group, Monsoon is often tasked with the responsibility of building initial prototypes and other small volume builds. While I have worked with many different shops across the nation, I've found Prototron to be the most consistent when it comes to shipping on time. Whenever schedule is important (and for us it almost always is) I really can count on Prototron to deliver...and every once in a while, even early! I've been sending boards to Prototron for over 10 years (literally hundreds of boards) and I am yet to see any quality issues at Prototron. They really are one of the best shops out there.

Paul Butler, CFO

Monsoon Solutions, Inc.

Bellevue, WA

**...and of course the customer is always right!**



# NEW PRODUCT SHOWCASE 2011

The IPC APEX Expo, April 10-14, 2011, at the Mandalay Bay Resort & Convention Center in Las Vegas, Nevada, will feature many new, exciting products on the show floor. Below you will find an extensive list of exhibitors offering new products and processes at this year's show. This was the most comprehensive list available from the IPC at press time.

**IPC APEX EXPO's eleven most exciting new products in the show are highlighted with a numbered red burst.**



## AccuAssembly — Booth #359

### Dry cabinets for feeder storage

Model CE-009 cabinet can be used to store placement machine feeders mounted with component reels.



### Benchtop AOI system

BAS economical inspection system is used to inspect PCBs with both through-hole parts and surface mount parts, parts up to 2" in height and down to 0603s can be inspected.



### Component Rack

The CR28 component rack is used to hold component reels in dry cabinets, the unit's flexible design can hold 7", 13" and 15" reels.



## Acculogic, Inc. — Booth #1435

### FLS 980Dxi Flying Scorpion™

The FLS 980Dxi Flying Scorpion is a patented double-sided, multi-probe flying probe system with 3D probing, analog, digital and boundary scan test capability on all probes.



### ScanNavigator™

Acculogic's ScanNavigator software offers full support for IEEE1149.6 and IEEE1149.7 extensions to the IEEE1149.1 standard.



### FLS940Sxi

Featuring single-sided test capability, the FLS940Sxi is a low-cost alternative to the Scorpion Flying Probe Tester line and can be equipped with up to 10 variable or fixed-angle probe modules.



### iCT7000™

Acculogic's iCT7000 InCircuit Scorpion is a small footprint in-circuit tester that can be configured with up to 2,048 all-real (non-multiplexed) channels and patented vectorless test techniques for detection of open pins on digital devices.



## ACE Production Technologies — Booth #500

### Dual Nozzle Selective Soldering Feature

The dual nozzle feature allows two differently-sized nozzles to operate in tandem, each one individually programmable, to handle a wide range of component types and sizes on an individual PCB assembly during the selective soldering process.





## **AIM — Booth #2058**

### **NC 258 No Clean Solder Paste**

The NC258 No Clean Solder Paste offers one of the longest pause-to-print windows in the industry, while enhancing fine print definitions. It reduces voiding and head-in-pillow, thereby reducing rework and rejected board costs to the manufacturer.



## **Air Products — Booth #621**

### **Inert Wave Soldering**

This patented technology provides nitrogen inerting in wave soldering applications and enables customers to reduce manufacturing and material costs, significantly increase soldering joint quality and allow for transition to lead-free soldering technology. Implementation can reduce key defects by up to 90% and can reduce dross formation by up to 90% in day-on-day production.



## **Alpha 1 Technologies — Booth #2235**

### **AlphaCom Software**

Windows replacement for Universal Instruments PPU Terminal software. Uses a Windows environment to communicate with older Universal Instruments equipment. Will work with all UICS-based machine executives.



## **American Hakko Products — Booth #2436**

### **Hakko FX-888 Soldering Station**

The Hakko FX-888 is an inexpensive and temperature-adjustable soldering station that provides more power and takes up less bench space than its predecessor, the Hakko 936.



### **Hakko FT-801 Thermal Wire Stripper**

The compact Hakko FT-801 thermal wire stripper has digital power control from 5 to 100%, locking process control that allows a set max power limit or full lock with no adjustment allowed, three-digit password security, an extra long, flexible cord for a long reach, an ergonomic hand piece, quick-change blades, sleep mode for longer blade life, auto power off for safety and much more.



## **Amistar Automation, Inc. — Booth #1947**

### **i-PULSE Model M20 Mounter**

The i-PULSE Model M20 can hold up to 144 feeders; is very flexible; can handle 01005 to 90 mm x 120 mm components; and is capable of PCBs measuring 47 in. long and up to 20 in. wide.



### **Koritsu Crusher MS-Z5**

Portable unit for destruction of sensitive materials such as Hard Disk drives, Flash Memory, Media Storage, Cell Phones, Paper - anything requiring immediate destruction for security reasons.



## **APS NOVASTAR — Booth #358**

### **Reflow Oven - ERO-500**

The ERO-500 utilizes convection heating technology to provide uniform temperature profiling across the entire PCB for enhanced SMT process control; has five top and five bottom vertical heating zones; and is an economic solution for low- to medium-volume production runs.



## **APS NOVASTAR — Booth #358**

### **LS60V-LED Automated SMT Pick and Place Machine**

The LS60V-LED utilizes APS Novastar's proprietary touchless centering system, providing placement rates of up to 4,800cph. The tool handles panels up to 800 mm in length and is available with an array of nozzles designed for the most common LED packages from CREE, Nichia and Philips Lumileds and Luxeon.



### **EWS-310 Wave Soldering Machine**

The economic conveyor wave soldering machine has durable "L" finger board handling for efficient, pallet-less transport for boards up to 310 mm; and features self-contained fluxing, preheating, and laminar (smooth) solder wave modules.

## **Aqueous Technologies — Booth #641**

### **Trident Zero**

The Trident Zero defluxing and cleanliness testing system is capable of removing all flux types including no-clean, rosin and water-soluble, and is capable of operating with a variety of environmentally safe defluxing chemistries frequently required for specific types of flux removal.



## **ASC International — Booth #1941**

### **VisionPro Series - Solder Paste Inspection Platform**

The VisionPro Series of solder paste inspection platform gives the SMT manufacturers the ultimate in flexibility with the option to use laser measuring technology, or white light phase shift technology, in the same low-cost platform.



### **VisionMaster HSi**

The VisionMaster HSi incorporates high-speed and high-resolution HSi positioning with sophisticated, ULTRA high speed 3-D measurement technology to provide the most automatic and accurate 3-D solder paste measurement tool in its class.



## **Assembleon America, Inc. — Booth #508**

### **MC-5X**

Consuming up to 30% less energy compared to competing models, the MC-5X combines the best features of the MC-5 chip shooter and MC-5 odd form placer in just 1.8 m2 of floor space. The 20k cph machine has up to 108 intelligent feeder slots, accepting a full component range with board sizes up to 575mm x 460 mm.



## **ASYS Group Americas Inc. — Booth #2437**

### **SIMPLEX MACHINE CONTROL SYSTEM**

The Simplex Machine Control System drastically reduces programming and set up times for EKRA screen and stencil printers. Its intuitive graphical representations reduce language barriers and the need for extensive operator training.



## **AXTEL, Inc. — Booth #1440**

### **A1\_Inspector**

The A1\_Inspector requires no programming, takes 1 to 2 minutes set-up time and yields QA results that meet and exceed AOI, but at a fraction of the cost.



## **BPM Microsystems — Booth #1428**

### **3800**

The 3800 fine-pitch automated device programmer combines BPM Microsystems' Vector Engine Co-Processor technology and on-the-fly vision centering in a single platform.



### **2800**

The model 2800 combines the Flashstream Vector Engine Co-Processor technology with 8th Generation universal support and uses the latest 64-bit architecture and 16GB of onboard memory.



## **Brock Electronics — Booth #647**

### **Cluso First Article Inspection System**

Featuring ball screw driven rails, the Cluso article inspection system now centers the PCB in the scanner module.



## **BTU International, Inc. — Booth #1425**

### **PYRAMAX™ Solder Reflow System**

The BTU dual-lane reflow ovens now make it possible to run boards with larger differences, simultaneously.



## **Caltex Scientific — Booth #2459**

### **Sony 3D TechnoLOOK scope**

The Sony TW-TL10ZR TechnoLOOK Scope features zoom of 10x to 100x.



## **Calumet Electronics Corporation — Booth #1937**

### **2011 Calumet Electro/Optical Printed Circuit Boards**

Calumet continues to develop manufacturing capability to produce circuit boards with optical interconnections that provide increased data processing solutions.



### **2011 PCB University Spring Semester**

PCB University is the only campus where you can access state-of-the-art PCB production videos showing actual processes using actual equipment.



### **2011 Material Declaration Management System**

Calumet releases new and Improved PCB content management for 2011, the company is committed to solutions that shield their customers from potential liability by providing accurate, up-to-date material declarations for every board they deliver.



### **2011 Calumet Inventory Management Plan**

Calumet Managed Inventory Plan offers demanding price reductions.



## **Chad Industries — Booth #2016**

### **CHAD IQps Low Cost Odd Form Insertion System**

Compatible with Chad's PIE 3-D Compliant Gripper and component feeding systems, the CHAD IQps offers users a low cost alternative to place one or two odd form components in their circuit boards.



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## Christopher Associates, Inc. — Booth #2211

### Tagarno Magnus HD Inspection System

The Magnus HD Inspection System combines HD imaging with advanced microscopy to enable users to inspect products with extremely sharp images and feature unsurpassed color reproduction.

### XR-4 X-Ray System

The Akila XR-4 X-ray system provides high-value and ease of use for inspecting excess or insufficient solder, voids, bridging and opens.



## Cincinnati Sub-Zero — Booth #1431

### CSZ EZT-570i Test Chamber Controller

The EZT-570i Test Chamber Controller includes more value and time-saving features, as well as support environmental testing.



## Count On Tools, Inc. — Booth #1965

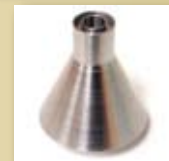
### Custom LED Nozzles for SMT Pick & Place Equipment

Count On Tools' LED nozzle series is available for all types of SMT pick-and-place equipment and tooling. Through cooperation with its customers, Count On Tools has expanded its current offering of custom LED nozzles for the following LED component suppliers: American Opto, CREE Edison Opto, Lumileds (Philips), Luminus (PhlatLight), Luxion (Rebel), Nichia, Osram Opto, Sharp and Seoul Semiconductor (P4).



### Count On Tools Introduces RPS Solder Nozzles

Count On Tools custom selective solder nozzles assist to replace labor-intensive hand soldering while eliminating defects caused by wave soldering machines in the market's most popular selective soldering equipment.



### Replacement Pace Pre-Filters (8883-0111-P5)

The replacement pre-filters provide up to 30% savings over original Pace Pre-Filters, making production more affordable. The Count On Tools Pacer Replacement Pre-Filters are low-efficiency particle filters used to protect the primary HEPA filter from large, coarse particles.



### Count On Tools Announces MYDATA Midas Tool Exchange Program

MYDATA Midas Nozzles can now be exchanged for a new tool at a discounted cost.



### Quad 8mm Feeder Peel Roller

The Quad 8mm Feeder Peel Roller (Blue Urethane) supports all standard Quad nozzles and z-rods (bellows) and is compatible with the following machine types: Quad C-Series, QSA-30, QSP-2, QSV-1, QSV-2, APS-1, APS-1H, Quad 4C and Quad 2C.



### Filters for Panasonic CM Nozzles

The XS filters for the Panasonic CM402 and CM602 nozzles are designed for the following nozzle types: 100-series, 100S-series, 200-series, 200S-series, 400-Series and 1000-series nozzles. They are also compatible with all Panasonic replacement nozzles for high-speed (eight and 12-nozzle, Type A-0 and A-2) and multi-functional (Type B) placement heads.



## Count On Tools, Inc. — Booth #1965

### Ace KISS Custom Wave Solder Nozzles

The ACE Custom Wave Solder Nozzles for the KISS range of selective soldering machines replace labor-intensive hand soldering while eliminating defects caused by wave soldering machines.



## CTI Systems — Booth #2549

### MR2 Router

The MR2 router features a fiducial camera, combination vacuum system with zero debris, and precision ground gantry movement system, making it one of the leading choices for PCB routing.



### MS2 Laser Marking System

The MS2 Laser Marking System has a precision ground split axis gantry movement system designed for improved cycle times. It also features a CTI Vision and fiducial camera, which is capable of fiducial recognition as well as 1D, 2D and QR code verification.



### CV Automatic Component Verification Machine

The CV Automatic Component Verification machine is designed to be an in-line golden board comparison system capable of identifying skewed components, polarity, presence and absence, as well as component part number verification.



### CM Coating System

The CM Automatic Coating machine is designed to be an in-line fully automatic coating system that has multiple options for spray patterns and dispense valves.



### CCV Conformal Coating Inspection Machine

The CCV Conformal Coating Inspection machine is designed to be an in-line fully automatic conformal coating inspection system for coverage area, as well voids within the patterns.



## CyberOptics Corporation — Booth #1749

### SE500 Solder Paste Inspection System

The SE500 3D Solder Paste Inspection System can inspect the most demanding assemblies with a >80 cm<sup>2</sup>/second inspection speed without compromising measurement accuracy and repeatability.



### QX500 AOI System

The innovative QX500 AOI system is designed with a unique image acquisition solution, the Strobed Inspection Module (SIM), which enables it to provide "on-the-fly" area-scanning inspection at 200 cm<sup>2</sup>/sec.



### SPC Software Process Monitor (PM)

CyberOptics' SPC Software Process Monitor (PM) is interactive statistical process control software that obtains real-time data from manufacturing.

## Datapaq, Inc. — Booth #231

### Datapaq PA2200A Selective Soldering Fixture

Based on the Datapaq Wave and Surveyor technologies, the Datapaq Selective Soldering Process Monitoring Solution features a compact, robust, easy-to-use fixture that is small enough and can be integrated into a carrier, while still providing room for a Datapaq Q18 logger to be located with it and pass through the process.



## DEK USA Inc. — Booth #1258

### ProActiv

The revolutionary printing technology ProActiv extends the print process window to a level that enables consistent printing of small apertures for 0.3 mm CSPs and 01005 passives, helping manufacturers rise to the challenges of increasing miniaturization and higher board densities.



### Nano-ProTek Fluxophobic Stencil Technology

The Nano-ProTek stencil coating technology delivers high-performance stencils in a cost-effective wipe to overcome the challenges of smaller aperture sizes.



## Digitaltest Inc. — Booth #2558

### Company Video

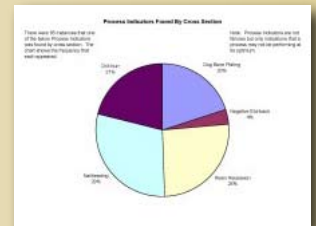
Digitaltest Company Video



## Divsys International, LLC — Booth #2535

### PCB Laboratory Product Assurance Testing

In-house PCB evaluation: Cross Section Analysis of Copper Thickness and Hole Quality Metallography with Thermal Stress Solderability Testing Hi Pot Testing Controlled Impedance Testing Modified Rose Testing with Ion Chromatography Hot Oil Delamination Testing Microcraft Flying Probe Electrical Testing SIR, Electromigration, CAF, IST, Elongation and Tensile Strength (Bath certification), XRF, IMDS Management Reporting.



## Dow Electronic Materials — Booth #1249

### SMT 520 Low Gold Immersion Gold Plating

Featured in the 2011 IPC APEX Expo Innovative Technology Center.



## Easy Braid Co. — Booth #2011

### EB9000 Soldering/Rework Station

The EB9000S Soldering/Rework Station uses Curie Heat Technology to provide very precise operation without the need for temperature calibration.



## ESSEMTEC — Booth #773

### Tucano

The EB9000S Soldering/Rework Station uses Curie Heat Technology to provide very precise operation without the need for temperature calibration.



### Paraquada

The Paraquada pick-and-place machine features new materials that provide higher quality as well as a new high-speed control system that provides both higher speed and precision.



### Cobra

Based on ePlace, the second generation Cobra assembly system is the world's most modern SMD pick-and-place machine and the first SMD pick-and-place system to combine the advantages of a highly flexible pick-and-place with the throughput of a multi-axes plater.



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## ESSEMTEC — Booth #773

### Tower

The Tower automatic storage system for SMD reels and trays can deliver up to 546 SMD reels or trays and requiring just 8 to 12 seconds to dispense any component required.



### EXPERT-SAFP

The EXPERT-SAFP placement system is perfectly suited for prototyping because it allows components to be picked from reels and sticks, and rest tape strips, as well as loose components.



### RO300FC-C

The RO300FC-C is a full convection oven that allows fast and homogenous heating, as well as high-temperature soldering of sensitive electronics.



### PANTERA-XV

The PANTERA-XV placement system features large feeder capacity and automatic identification, suited to the standards of a high-mix/low-volume production.



## Europlacer North America — Booth #1073

### iineo-II VLB

The dual-head iineo-II VLB assembler can accommodate PCBs as large as 24 x 63 in., making it suitable for handling LED form factors, particularly industrial fluorescent lighting.



## Everett Charles Technologies — Booth #447

### The Edge™

The Edge provides an economical, sharp, aggressive and shallow angle blade tip for reliable via probing on PCBs by incorporating ECT's patented ZIP flat technology manufacturing cost advantages.



### LEDCHECK™

The LEDCHECK II and the LEDCHECK VIII are two- and eight-channel modular assemblies designed specifically for true color testing, including color and intensity at ICT or as a standalone unit.



## FCT Assembly — Booth #262

### NL930PT Pin Probable Solder Paste

The NL930PT is a no-clean, lead-free, halide-free pin probable solder paste that features a clear residue, pin probable paste that can print down to low surface area ratios consistently.



### NL932 No-Clean Solder Paste

The NL932 no-clean, lead-free, halide-free solder paste features excellent solderability, enabling the process to handle the most difficult wetting requirements.



### WS888 Lead-Free Water Soluble Solder Paste

The WS888 lead-free water soluble solder paste provides excellent wetting on all surface finishes with consistent printing down to low surface area ratios and can be run in R/H of 30 to 65% without slump.



## **FCT Assembly — Booth #262**

### **SN100C Bar Solder**

SN100C Bar Solder is used in thousands of wave soldering machines around the world and has proven its reliability in products exposed to the most severe service environments.

### **UltraSlic Stencil with Nano-Coating**

The UltraSlic Stencil with Nano-Coating stencil technology prevents the solder pastes from sticking to the stencil apertures and the bottom side of the foil, making it the preferred choice when printing assemblies with challenging miniature components.

### **Root Cause Analysis Service**

Representatives from FCT Assembly and Fine Line Stencil will be on hand at the show to discuss the company's innovative Root Cause Analysis Service.



## **FKN Systek — Booth #2237**

### **Rectangular Heavy Duty Connectors**

Rectangular Connectors are available in 12 styles, voltage ranges from 50 to 1,000 volts and current carrying capacity is from 5A to 100A.

### **Output Conveyor 12" wide for K5000 Depanelizers**

FKN Systek has developed a 12-inch wide output conveyor for the K5000 multiple blade depanelizer, a manually fed and unloaded depanelizer used for high-volume production of pre-scored PCBs.



## **Fuji America Corporation — Booth #759**

### **Fuji AIMEX Placement System**

The AIMEX Placement System is an expandable all-in-one placement system that allows additional gantries and placement heads to be added to the machine quickly and easily when production demands an increase in output.

### **Fuji NXTIIc Compact Placement System**

The NXTIIc Compact Placement System has all the same features as the standard NX-TII, but in a footprint that's 26% smaller.



## **GPD Global — Booth #2241**

### **PCD Dispensing**

The PCD Dispensing provides next-generation volumetric dispensing and is compatible with materials used in electronics assembly such as epoxies, thermal greases, underfills, oils, silicones and UV encapsulants.



## **Heraeus — Booth #2334**

### **SolderPro**

Pb-free solder pastes, wire and flux with outstanding wetting on Nickel and other surfaces.

### **InnoRel**

Special Pb-free alloys/solder pastes for improved reliability on PCB and on Ceramic Substrates





## Heraeus — Booth #2334

### Magic

Microbond Silver contacting pastes for Power Electronics, Die Attach on lead frames, LEDs.

Outstanding thermal and electrical conductivity + enable field operating temperatures exceeding 200 °C.

### Halogen free

SMT-Adhesives: PD 208 adhesive series meet halogen free requirements acc. to IEC 61249-2-21



## Henkel Corporation — Booth #1158

### Macromelt® OM341

Macromelt is a robust, environmental-friendly alternative to traditional potting and injection molding encapsulation techniques. It can encapsulate exposed circuitry to form the outer shell of the device, thus delivering a self-contained integrated assembly.



## HUBER + SUHNER AG — Booth #1385

### Multicoax series MXP

The new 40 Gbps multicoax solution MXP is especially suited for high-speed digital test applications.



## Huntron, Inc. — Booth #2216

### Huntron Access DH

The Access DH Prober is a dual head Robotic Prober that is best suited for low-volume PCA testing where interfacing between two points is necessary; it allow economical, automated testing of densely packed surface-mount and other devices on the most complex boards from the smallest to the largest systems.



## IBL Technologies LLC — Booth #247

### Vacuum Vapor Phase Reflow Machine

The IBL Vacuum Vapor Phase Soldering system significantly increases the reliability of the finished product by operating in a complete inert atmosphere through the entire reflow and vacuum process.



### Premium Vapor Phase Reflow SLC 509

The Premium SLC 509 offers small- to medium-sized companies a reflow vapor phase machine that has a very small footprint and does not require an exhaust system installed in the building.



## Inovaxe Corporation — Booth #764

### Suitcase-Sized Kit Cart

The 22 x 22.75 x 15.25 inch Suitcase-Sized Kit Cart is designed to replace the complete SMT kitting function for the production floor and can also be utilized for inventory purposes with New Product Introduction (NPI).



### InoCart MSD

New Web-based software with additional features and controls promote unparalleled inventory accuracy within the conventional stockroom, the lean manufacturing/floor stocked discipline and WIP environments.



## **Inovaxe Corporation — Booth #764**

### **InoKit**

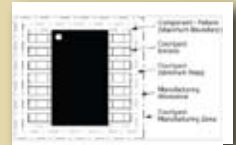
Inovaxe's portable InoKit carrier and associated software can reduce the high cost of acquisition and handling of "C parts" while eliminating shortages on the production floor.



## **IPC-Association Connecting Electronics Industries — Booth #201**

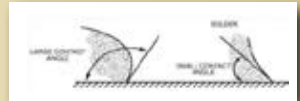
### **IPC-7351B, Generic Requirements for Surface Mount Design and Land Pattern Standard**

IPC-7351B includes both the standard and an IPC-7351B land pattern calculator on CD-ROM for accessing component and land pattern dimensional data.



### **IPC-1601, Printed Board Handling and Storage Guidelines**

The guidelines in this document are intended to protect printed boards from contamination, physical damage, solderability degradation and moisture uptake.



### **DVD-18C, Soldering Terminals**

The 37-minute video covers industry best practices for soldering wires to commonly used terminals in accordance with the latest IPC-A-610E and J-STD-001E acceptance standards.



### **IPC-DRM-PTH-E, Through-Hole SolderJoint Evaluation Training & Reference Guide**

Now updated to Revision E of the latest IPC-A-610 and J-STD-001 - this IPC Training & Reference Guide illustrates critical acceptance criteria for the evaluation of through-hole solder connections.



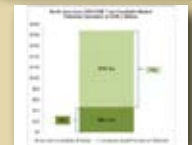
### **IPC-DRM-SMT-E, Surface Mount Solder Joint Evaluation Training & Reference Guide**

Now updated to Revision E of the latest IPC-A-610 and J-STD-001 - the IPC Training & Reference Guide illustrates critical acceptance criteria for the evaluation of surface mount solder connections.



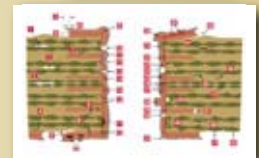
### **2009-2010 Analysis and Forecast for the EMS Industry**

Survey-based study presents data and analysis on the EMS industry, examining trends in sources of revenue, revenue per employee, services offered, markets served, manufacturing technology, capital investment, spending on equipment and materials and market size, including forecasts and potential for market expansion.



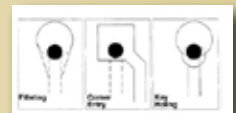
### **PCB Multi-Issue Microsection Wall Poster**

Dubbed the "nightmare microsection," this full-color, 24 x 36-inch (60 x 90 cm) wall poster identifies 42 phenomena that can be seen in cross-sections of plated-through holes.



### **IPC-2222A, Sectional Design Standard for Rigid Organic Printed Boards**

Used in conjunction with IPC-2221, IPC-2222 establishes the specific requirements for the design of rigid organic printed boards and other forms of component mounting and interconnecting structures.



### **IPC-1071, Best Industry Practices for Intellectual Property Protection in Printed Board Manufacturing**

This standard was developed to assist printed board manufacturers in the development of requirements for the protection of intellectual property (IP) for their customers in commercial, industrial, military and other high-reliability markets.



## **iTherm Technologies — Booth #221**

### **HIG 1.4**

Air cooled 1 kW induction heating power supply, well suited for induction soldering and joining applications.



## **JNJ Industries — Booth #2565**

### **EquaStat ESD Roll**

A heavy weight woven fabric made from continuous filament polyester interwoven with DuPont Negastat® carbon yarn to provide a static dissipative fabric, this fabric can be metered out and cut to length to be used to provide an ESD-safe covering for a variety of work surfaces.



## **JTAG Technologies — Booth #1638**

### **JTAG Live**

JTAG Live allows design engineers to debug boards too crowded for traditional probing; to sense signal levels on prototype PCBs, verify proper continuity between pins or groups of pins and check basic operation.



## **Juki Automation Systems — Booth #1559**

### **KE-1070/1080 Modular Placement Systems**

With the flexibility to place 01005 to CSP and odd formed parts, these machines feature quick and easy change over that leads to extremely high up-time, yielding the lowest cost of ownership.



### **JX-200LED**

The JX-200LED features a new upward looking camera for QFP/QFN lead inspection and BGA ball inspection, as well as 1,200 mm board capability with multi-indexing.

## **KIC — Booth #1964**

### **MVP Profile Fixture**

The MVP profile fixture is ideal for viewing changes in reflow ovens and determining how those changes affect the profile of production boards, when the MVP detects an out-of-spec situation, the software will give information on how to adjust the oven to meet specifications.



## **Lackwerke Peters GmbH + Co KG — Booth #476**

### **Opaque black and white conformal coatings ELPEGUARD® SL 1347 and ELPEGUARD® SL 1397**

The ELPEGUARD conformal coatings SL 1347 and SL 1397 are used primarily in the field of optoelectronics to protect LED assemblies; SL 1397 ensures maximum luminous efficacy; SL 1347 ensures a strong contrast to the base material.



## **Magenta Systems — Booth #1525**

### **ALD 510 AOI**

Made for pre-reflow, mixed-mode and post-reflow applications, the ALD510 AOI machine utilizes the acculite lighting color technology using multiple angles of light, from a single image, to determine different characteristics of each component and appropriate solder coverage on both sides of the board.



## Magenta Systems — Booth #1525

### ALD520 AOI

The ALD520 AOI also utilizes the acculite lighting color technology using multiple angles of light, from a single image, to determine different characteristics of each component and appropriate solder coverage on both sides of the board.

### ALD700 AOI

The ALD 700 AOI offers full in-line capabilities with large scale and complicated production line.

### TF-450S The SmartCoating Selective coating

The SmartCoating TF-450S SmartCoating Selective coating machine eliminates extensive masking and rework, delivering a perfect solution for bringing the effort and costs of pre-masking down, while achieving a uniform and precise coating layer.

### VS-500 Soldering System

The VS-500 is a compact yet versatile and powerful off-line vapor soldering system that is capable of soldering the most complex SMT boards up to 500 mm x 500 mm.

### Microscope

The Trinocular Stereozoom Microscope features a 45° inclined, 360° rotating Trinocular head, WF10X/20 mm, high-point eyepieces and magnification up to 45x.

### Dry Cabinet

XDL1200/6 type is a plug and play, fully auto-dry cabinet which will be stable at  $\leq 5\%RH$ . There is no need to set the panel buttons at all. It is especially designed for moisture sensitive SMD packages to comply with J-STD-033B.



## Malcomtech International — Booth #458

### PC-10 Table top viscosity tester

The PC-10 viscosity tester simplifies testing of solder paste viscosity and temperature.



## Martin (a Finetech Company) — Booth #1940

### Mini-Oven Reball/Prebump unit

Using a unique Hotprint Technology, wherein the mask is not removed after printing paste, but remains on the QFN during reflow, the Mini-Oven Re-ball/Pre-bump unit is ideal for the complete QFN solder bumping process, even for the smallest pitches.



### Expert 10.6

The Expert 10.6 is a cost-effective rework system with an intuitive interface, process repeatability and semi-automated operation and has a leading-edge camera driven alignment system that provides a flawless solution for the automatic placement process.



### FINEPLACER® core

Featuring a semi-automated design that includes force measurement with automatic component lift-off and placement, the FINEPLACER core offers proven rework technology for a wide spectrum of SMT components, ranging in size from 0201 to 70 mm x 70 mm BGAs, and handling PCBs up to 300 mm x 400 mm.



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## Maskless Lithography — Booth #517

### MLI 3000 Direct Imaging System

The Maskless Direct Digital Imaging system has the highest throughput in the PCB Industry using its patented Gray Level Imaging process.



## MET Associates — Booth #1843

### Nano-ProTek

Nano-ProTek is a fluxophobic stencil coating technology utilizing a cost-effective wipe, it offers a unique solution to increase cleaning effectiveness and reduce cleaning effectiveness.



## Microtek Labs — Booth #2119

### Microtek signs PPP with UL

Microtek Labs in Anaheim, California has signed the UL Preferred Partner Program (PPP) agreement for the ZPMV, ZPXK and ZPVI Printed Circuit Board categories.



### Microtek Celebrates 25-Years of Service to the PCB Industry

The year 2011 marks an important 25-year milestone for Microtek Laboratories, a leading independent test lab in the electronics industry headquartered in Anaheim, California.



## Milara/Mirae — Booth #1873

### TD2929 with CyberOptics 3-D High Speed Post-Print Inspection Head

The TD2929 can provide 3-D high-speed post-print paste inspection at full line speed using CyberOptics' industry-leading SE500 technology.



## MIRTEC Corporation — Booth #1925

### MV-7xi In-Line AOI System

Fully configured this system provides one top down view Five Mega Pixel camera, with a Precision 9.8 Micron Telecentric Compound Lens and four Five Mega Pixel Side-View Cameras.



### MV-3L Desktop AOI System

The MIRTEC MV-3L Desktop AOI configured with a Top-Down View 10 Mega Pixel camera with a Precision 13.4 Micron Telecentric Compound Lens and four 10 Mega Pixel Side-View Cameras. It also features the Intelli-Beam Laser System.



### MS-11 In-Line SPI System

The MIRTEC MS-11 In-Line SPI System, configured with 15M pixel ISIS Vision System for enhanced image quality, superior accuracy and lightening fast inspection rate, uses Shadow-Free Moiré Phase Shift Imaging Technology to inspect solder paste deposition on PCBs post screen print.



## NEC Avio Infrared Technologies/SOLTEC Corp. — Booth #227

### NEC Avio Infrared Technologies Introduces New InfReC R300 High-Performance, Multi-Purpose Infrared C

InfReC R300 High-Performance, Multi-Purpose Infrared Camera Wide application range includes product development, energy audits, R&D, PPM, building inspection; NEC Avio Infrared Technologies introduces its new InfReC R300 high-definition thermal imager with a host of advanced capabilities.



## **NEC Avio Infrared Technologies/SOLTEC Corp. — Booth #227**

### **Battery Tab Precision Welding System**

The Avio Hybrid Battery Tab Precision Welder is ideally suited in welding of battery tabs to battery electrodes to form a battery pack.



### **Capacitor Discharge Welding System: NRW-DC150**

The NRW-DC150 precision resistance welder is a capacitor-discharge type welding power supply, which is used in the assembly of electronic equipment and components.



### **Thermo Gear G120/G100**

The G100 and G120 high-resolution, portable thermal imaging cameras (InfReC series) feature the world's first Panoramic Thermal Image Recording feature (G120) that, as the camera is panned in a vertical or horizontal plane, automatically captures and stores sequential thermal images.



### **Perfect PdM Thermal Imager: Thermo Gear G30**

The G30 Thermal Imagers, part of the InfReC series, simultaneously records and displays visual and temperature data images.



## **Nihon Superior Co., Ltd. — Booth #259**

### **SN100C (044) Flux-Cored Solder Wire**

The SN100C (044) halogen-free high performance flux-cored solder wire makes it possible to achieve a high first-pass yield because of its excellent wetting and spread, while providing an approximately 30% faster soldering speed in manual soldering when compared to the company's previous halogen-free flux-cored solder wire.



### **SN100C P603 D4 and SN100C P605 D5/D6 Solder Pastes**

The SN100C P603 D4 and SN100C P605 D5/D6 dispensing grade completely halogen-free lead-free solder pastes offer superior dispensing stability, which ensures no skipped pads, helping to achieve improved reliability, high productivity and cost reduction.



## **North Star Imaging, Inc. — Booth #441**

### **eXpress-CT In-line Computed Tomography System**

The eXpress-CT In-line CT features 3-D Automatic Defect Recognition (ADR) to provide a revolutionary solution for 100% complete 3-D CT inspection on the production line.



## **Omron Inspection Systems — Booth #1058**

### **VT-RNS II: Cost Effective AOI Platform**

The VT-RNS II AOI Platform provides 20% faster inspection than the previous RNS platform, supports paste inspection, pre-reflow or post-reflow inspections in a single machine, and utilizes the Patented 3-Color Highlight technology.



### **VP5200: High Speed 3D SPI Platform**

The VP5200 High Speed 3-D SPI Platform is two times faster than conventional models.



## **Opticon, Inc. — Booth #2440**

### **Opticon MDI2300 2D CMOS Imager Barcode Scan Engine**

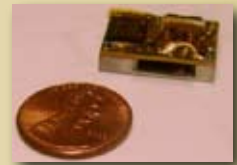
The Opticon MDI2300 is a 2-D CMOS Imager barcode scan engine built around Opticon's innovative auto-focus technology, which enables the engine to quickly and efficiently scan 1-D or 2-D barcode images, while its real-time adapting liquid lens self-adjusts for distance and angle.



## **Opticon, Inc. — Booth #2440**

### **Opticon MDL4000 Laser Barcode Scan Engine**

This new laser barcode scan engine is fully decoded and features a Class 1 laser, it is ideal for OEMs looking for a tiny, low power (3.3 volts) laser barcode scan engine for mobile terminals, medical devices and small form factor kiosks.



## **PACE Incorporated — Booth #2416**

### **XR 3700 X-Ray Inspection System**

Ideal for inspecting BGAs, CSPs and other components for solder bridging, cold solder joints, missing solder balls and solder voids, the XR 3700 X-Ray inspection system meets the demands of rework operations, while maintaining the performance of more expensive systems.



### **ST-1600 Four Zone Pre-heater**

The ST-1600 Four Zone Pre-heater is ideal for Pre-heating PCBs where temperatures must be controlled or monitored to protect adjacent components or other surface areas.



## **Panasonic Factory Solutions Company of America — Booth #2259**

### **PanaCIM Enterprise Edition Version 8.3**

Panasonic Factory Solutions Company of America's latest version of PanaCIM Enterprise Edition manufacturing execution system (MES) software has been expanded to include additional equipment from non-Panasonic vendors.



### **Next Production Modular Wide (NPM-W) Placement Machine: Wider, Deeper, and More Inputs**

The Next Production Modular Wide (NPM-W) Placement Machine of Panasonic Factory Solutions Company of America is a new platform for processing PCBs up to 750mm x 550 mm in size, placing components up to 120 mm x 90 mm, and accommodating up to 120 8-mm feeder inputs.



### **RL132 Radial Insertion Machine - Generation-Ahead Platform & Spatially-Efficient Footprint**

The RL132 Radial Insertion Machine of Panasonic Factory Solutions Company of America offers generation-ahead technologies in a spatially-efficient footprint and features a lead chuck system that provides insertion at 25,700cph (0.14s/component).



## **Pillarhouse USA — Booth #1525**

### **New—Inline Fluxer/Preheater Combo**

The Inline Fluxer/Preheater Combo modular inline system utilizes the same design concept as the new generation Orissa Synchrodex soldering cell and offers the user significantly reduced process time when compared to a single soldering unit with on-board fluxing and pre-heat functions.



### **New—X-Y-Z Encoders**

The X, Y and Z-Axis Encoders will be available on all Pillarhouse's newest equipment lines, which includes the Handex and Synchrodex machines, as well as the Jade MKII.



### **NEW—PCB Laser Warpage Correction System**

The PCB Laser Warpage Correction option on all selective solder platforms allows the measurement and correction for height variations of the PCB by means of a laser displacement sensor.



## **Pillarhouse USA — Booth #1525**

### **PillarCARE and PillarPROCESS**

Pillarhouse now offer two new cost-effective customer support packages, PillarCARE and PillarPROCESS is offered to customers with the Jade, Jade Handex or Orissa Synchrodex selective soldering equipment.



### **PillarDot**

The PillarDot drop jet liquid delivery system can be used to spray fluids at any angle in either upward or downward directions. Suitable for automation use, the PillarDOT system can also be supplied as part of an X, Y axis unit with conveyor transfer.



### **Nitrogen purity monitoring (closed loop)**

As an option to the Pillarhouse range, an internal oxygen analyzer can be fitted to provide closed loop feedback to the machine via the PillarCOM operating software, which monitors the nitrogen purity and alerts the operator via an alarm, if the purity falls outside the set PPM limit of the program.



### **Solder Reel Coding**

This option identifies of the solder reel fitted to the machine, the program checks the reel when loaded to make sure the correct solder is fitted in the feeder before the program will run.



### **Solder Pot Coding**

When a program is loaded, the PillarCOMM software checks the pot identity to make sure it's the correct pot for the loaded program.



### **Jade MKIII**

Stemming from the globally successful Jade platform, the new MKIII now includes a larger solder bath with added process capabilities, new auto solder pot changer (lead and lead-free) and pot warming station all contained in one compact cell.



## **Precision Placement Machines — Booth #2461**

### **New Quad 4000C Pick and Place**

PPM offers the field proven "C" series SMT placement systems for economical, high-precision SMT production. Integrating ultra-fine pitch precision with system flexibility, these modular assemblers offer a comprehensive range of solutions for diverse SMT applications.



## **Production Solutions, Inc. — Booth #351**

### **RED-E-SET GO**

The GO model is a low-cost board support tooling solution designed for those applications that do not require rigid-fixed height support. It uses a patent-pending design of spring loaded pins and ESD-safe open cell memory foam and provides the benefits of both pin and foam.



## **PROMATION, Inc. — Booth #326**

### **PROFLEX Soldering Robot**

PROFLEX's modular design allows us to integrate hot iron system, diode laser system, hot air system or a combination of two technologies.



### **Post AOI Sort & Rework Station**

PROMATION's ESB-300 is designed for mid- to high-volume, post AOI sorting, review and rework that keep your production line flowing while these activities are occurring.





## PROMATION, Inc. — Booth #326

### Automatic Label Placement System

PROMATION's 600dpi ELP-1100p Label Placement systems provide high-resolution labels for small or tight area placement.



## Qualectron Systems Corporation — Booth #2077

### X-eye 5000BTS

X-eye 5000BTS standalone X-ray machine uses 90kV micro-focus X-ray tube with 5 micro focal spot size, and comes with an XYZ and tilt function with table size of 500 mm x 400 mm and magnification of up to 450x.



### 3D Master 3000

3D Master 3000 is an offline 3-D SPI machine that can measure solder height down to 1 micro.



## Qualitek International Inc. — Booth #651

### Bi58 Low Temp. Lead Free Soldering Kits

Qualitek's low temperature, lead-free soldering kits are a recommended lead-free soldering alternative for heat sensitive assembly that requires a low melting point.



### Halogen 0% ppm Soldering Materials

The difference between Qualitek's Halogen-Free and Halogen 0 is that Qualitek's halogen-free products adhere to the adopted levels developed by the IEC as acceptable in final assembled product for the most robust halogen-free formulations.



### SN100e Lead Free Solder Alloy Alternative

SN100e Lead Free Solder Alloy Alternative is a lead-free alternative for costly SAC alloys and for those switching from Sn63/Pb37 to the lead-free process.



## Quasys AG — Booth #2529

### JTF3 Multi Component JEDEC Tray Feeder

The new JTF3 Multi Component JEDEC Tray Feeder is working with magazines and random access. It can handle a magazine with 18 thin JEDEC trays.



## R&D Technical Services — Booth #2635

### RD1 Batch Type Vapor Phase Reflow System

The RD1 uses vapor phase technology to provide consistent, uniform heat transfer for high-quality reflow, curing and drying. The system can also accommodate low-volume production and smaller sized products.



## Rogers Corporation — Booth #816

### RT/duroid® 6035HTC Laminate

High frequency materials are ceramic filled PTFE composites for use in high power RF and microwave applications.



## Saki America, Inc. — Booth #1173

### BF-X1

In-line 3-D CT X-ray auto-inspection system named "BF-X1" is capable in detecting cold solder and head-in-pillow under BGA.



## Saturn Electronics Corporation, PCB Fabricator — Booth #2210

### Via Hole Filling

Installed a MASS horizontal VHF 300 VS with vacuum for PCB through holes, blind via and selective via hole filling.

### UL Certification for Nelco 4000-13

Nelco 4000-13 series of materials include -13, -13SI, -13EP, -13EPSI.

### UL Certification for Additional Thermal Management Materials

Include offerings from Bergquist (MP & HT), Iteq (IT-859GTA & IT-889GT) and Ventec (VT-4A1 & VT-4A2).

### Automotive High Reliability Certification

The relevance to non-automotive customers is that Saturn passes 100% of product through this high-reliability certified process, making it a benefit to all customers.

### Flexible Printed Circuit Boards (Flex PCB)

Saturn now provides flexible and rigid-flex prototype and production fabrication with advanced technologies to include flex LED PCBs, embedded heatsinks and printed electronics.



## Schleuniger, Inc. — Booth #446

### PowerStrip 9550

The PowerStrip 9550 combines the utmost in precision and performance, covering the widest possible range of applications.



## Schmitt Industries, Inc. — Booth #219

### Lasercheck

The Lasercheck system uses patented laser "light scatter" technology to provide surface roughness measurement with superior durability, measurement speed and repeatability.



## SEHO North America, Inc. — Booth #565

### PowerSelective

SEHO's PowerSelective features a modular design that ensures the highest flexibility and can be customized to meet specific production requirements.



### SelectiveLine

Featuring a high-precision, mini-wave process, the SelectiveLine is ideally suited for a high product mix, offering maximum flexibility, particularly for small- and medium-sized production volumes.



### PowerWave

SEHO's PowerWave features up-to-date solder nozzle geometries and flexible pre-heat area.



## SEICA Inc. — Booth #2247

### QuickTest

QuickTest is a point and click intuitive environment to augment ICT programs on Flying Probers with easy to run functional tests.



11

## Seika Machinery, Inc. — Booth #459

### Solder Paste Recycling Unit

The Solder Paste Recycling Unit enables approximately 90% of waste solder paste to be recovered as solder bar and provides a major decrease in disposal costs for factory waste, in particular, a reduction in CO2 emissions.



### Sawa Eco-Roll Large Roll Model

The Sawa Eco-Roll Large Roll Model cleans wiper rolls up to 24". It eliminates waste and saves money by reusing wiper rolls for printing machines, and also allows reduction of CO2 emissions.



### Ecobrid Stencil Cleaner

The new Sawa Ecobrid hand-held and fully-automatic low-VOC emission stencil cleaner provides up to a 66% reduction in CO2 emissions, as well as a huge reduction in operating costs.

### McDry MC-1002 PCB Storage Cabinet

The system features new economy prices with the high performance and value that McDry is known for. It comes in 1% and 3% RH models to comply with the strict standards required for proper storage of moisture-sensitive materials.



### Seitec Bravo STS-2533 IN H & SJ Soldering System

Seitec Bravo STS-2533 IN H & SJ Soldering System is specially-designed for in-line and modular selective soldering.

## Senju Comtek Corporation — Booth #2273

### M40 & M46 Solder Paste Series

M40 & M46 are low-Ag alloys for SMT process designed to effectively reduce the material cost without sacrificing the quality and performance of the industry's standard SAC305 alloy.



## Siemens PLM Software — Booth #2548

### UniCam FX 9.1

UniCam FX's enhancements range from data preparation to machine programming and optimization, ensuring that new products can be introduced quickly and correctly the first time.



### Test Expert 9.1

Test Expert's enhancements range from data preparation to machine programming and optimization, ensuring that new products can be introduced quickly and correctly the first time.

## Smart Sonic Stencil Cleaning Systems — Booth #2071

### EnviroGuard 100% Closed-loop Stencil Cleaners

EnviroGuard is a unique closed-loop filtration system that replaces the need of a waste water evaporator and other antiquated waste management technologies.



### Low Cost Series 500 Ultrasonic Stencil & Pallet Cleaners

The 500 Series of ultrasonic stencil and pallet cleaners comes in modular form and features individual power cords for the power drain pump, ultrasonic generator, heater, etc.



## Smart Sonic Stencil Cleaning Systems — Booth #2071

### 440-R SMT Detergent Spray for Manual Stencil Cleaning

440-R SMT Detergent comes in a ready-to-use spray bottle for safe and effective manual cleaning of SMT stencils and related tooling. It is the most widely used and only stencil-cleaning chemistry verified for specific parameters of environmental safety, user safety and cleaning efficiency by the U.S. EPA's Environmental Technology Verification Program.



### ErgoSonic Automatic Ultrasonic Stencil & Pallet Cleaner

The ErgoSonic Stencil Cleaner facilitates front-loading of the stencil at a safe and comfortable height and does not require a stencil basket. It is fully automatic, programmable and compatible with many aqueous cleaning chemistries.



## SMT North America, Inc. — Booth #2083

### SMT HTT

The HTT has been designed especially for drying and tempering films and adhesives, as well as curing every kind of pottant ready for subsequent heat testing.



### SMT UV

SMT will offer in the near future Conformal Coating Systems with thermal or UV curing capability and the ability to apply protective coatings in a full surface or sequential mode.



### SMT Vacuum Plus N2

The Vacuum Plus N2 System is designed as a module that is placed between the heating and cooling section of an SMT reflow system, making available another process step toward perfecting soldering technology.



### SMT Quattro Peak L10 AP

The SMT Quattro Peak L10 AP Forced Convection Reflow Soldering System features 10 heating zones and supports multi-stage condensate management.



## Sono-Tek Corporation — Booth #1535

### SonoFlux Servo GP

With a precision gear pump liquid delivery system, the SonoFlux Servo GP offers precise control of the flux quantity being delivered to the PCB, allowing the flexibility to apply ultra-thin to very thick flux layers, depending on the PCB requirements.



## Specialty Coating Systems — Booth #1277

### Ionograph System with On-Board Computer

Specialty Coating Systems' Ionograph SMD II ionic contamination test system has an on-board all-in-one computer, which operates the system using proprietary SCS PowerView software.



## Suntech Circuits — Booth #711

### Flex & Rigid - Flex - HDI

The company now offers quick-turn, low-volume and full production capabilities for flex, rigid-flex and HDI board requirements.



## Taiwan Union Technology Corporation (TUC) — Booth #1034

### Metal Copper Clad Laminate TU-322

TU-32 series, MCCL, offers an effective solution to the thermal problem in the electronic field. With high thermal conductive insulator on aluminum or copper, it rapidly transfers the heating from component side to the back of the substrate.



## Taiwan Union Technology Corporation (TUC) — Booth #1034

### MCPCB MassLam Service

TUC works with OEMs and PCB fabricators to help design circuit boards using the TU family material, to provide high value-added service, MCPCB MassLam for customers.



### TU-872 LK/SLK (Low Dk/Df)

TU-872 LK/SLK is a high-performance, modified epoxy FR-4 resin system reinforced with regular woven E-glass, designed with low dielectric constant and low dissipation factor for high-speed, low loss and high-frequency multi-layer circuit board application.

### TU-747 HF (Halogen Free Laminates)

TU-747 HF/TU-747P HF halogen-free materials are formulated with epoxy resin, a non-PN (free phenolic group containing) curing agent and impregnated onto standard E-glass fabric.

## TEAM A.T.E. — Booth #2038

### Purchase Parts 24/7 at TEAM A.T.E.'s online Parts Store

TEAM A.T.E. now sells spares and parts at its online parts store. Bookmark [www.partstore.team-ate.com](http://www.partstore.team-ate.com), your new primary resource for spare parts.



## Test Research USA, Inc. — Booth #549

### TR5001T Tiny In-Circuit Tester

The TR5001T is a tiny in-circuit tester with high testing speeds and accuracy and provides a maximum of 640 test points.



### TR7007 3D Solder Paste Inspection System

The TR7007 features ultra-high speed, shadow free optical inspection of 171cm<sup>2</sup>/sec at a 14µm resolution using fringe pattern technology. It is equipped with a linear motor and linear scale DSP that provides a highly accurate X-Y table system.



## Viscom Inc. — Booth #2047

### S3088 SPI - 3D solder paste inspection

The inspection system S3088VPI was conceived to detect defects early in the production run.



### S3088 flex - AOI system with vVision software

The new user interface vVision revolutionizes AOI inspection system operations.



## Vitronics Soltec — Booth #971

### XPM3i Reflow oven

The XPM3i features a GRS with a 30-50% lower nitrogen consumption; patented process gas circulation; and the cleanest oven in the industry.



## ViTrox Technologies Sdn Bhd — Booth #1283

### V810 - Automated X-Ray Inspection Machine (AXI)

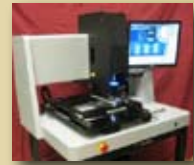
The V810 Automated X-Ray Inspection Machine deploys state-of-the-art hardware, scanning & image acquisition technology to guarantee speed & throughput, without sacrificing accuracy.



## VJ Technologies — Booth #2419

### SRT Micra

The SRT Micra SRT platform, available in bench top format, is designed for the rework of mobile products incorporating small, high-density electronic devices such as smart phones, netbooks, GPS and other handheld products.



## World Mastery Technology Ltd. — Booth #513

### Multi-layer PCBs

8 Layer, HDI, Immersion gold finish, 1+6+1 structure, 0.8 mm finished thickness, 4 mil line width spacing, 0.2 mm hole, BGA 0.3 mm.



### Alum. PCB

Aluminum-based material, one-layer, HAL finishing, for the application of Automotive products. ENIG and Immersion tin can also be applied.



## ZESTRON Corporation — Booth #241

### ATRON® AC 207

The ATRON AC 207 is a FAST Technology-based cleaning agent developed to improve the cleaning performance and bath life of traditional surfactant-based cleaners and is designed to operate at low concentration levels.



## SMTA Webtorial to Address PCB Defects

SMTA is offering a Webtorial featuring a presentation from Michael Carano of OMG Electronic Chemicals. Carano will discuss Final Finishes and Their Compatibility with Lead-Free Assembly on April 21 and 28, 2011.

More information and registration is available [here](#).

### Overview

This course will address advanced problem solving of PCB defects. Defects, such as interconnect separation, delamination, wedge voids, plating folds, microvoids, surface pitting and hole wall pull-away, carry significant costs. Many are difficult to solve because the root cause may not be readily apparent and multiple factors may contribute.

This course will explore the most intricate of these factors and how the inter-relationship of both up and downstream processes contributes to scrap product. What effect does drilling have on hole wall quality and the subsequent metalization process? Participants will learn how to recognize problems like this and take corrective action before it is too late.

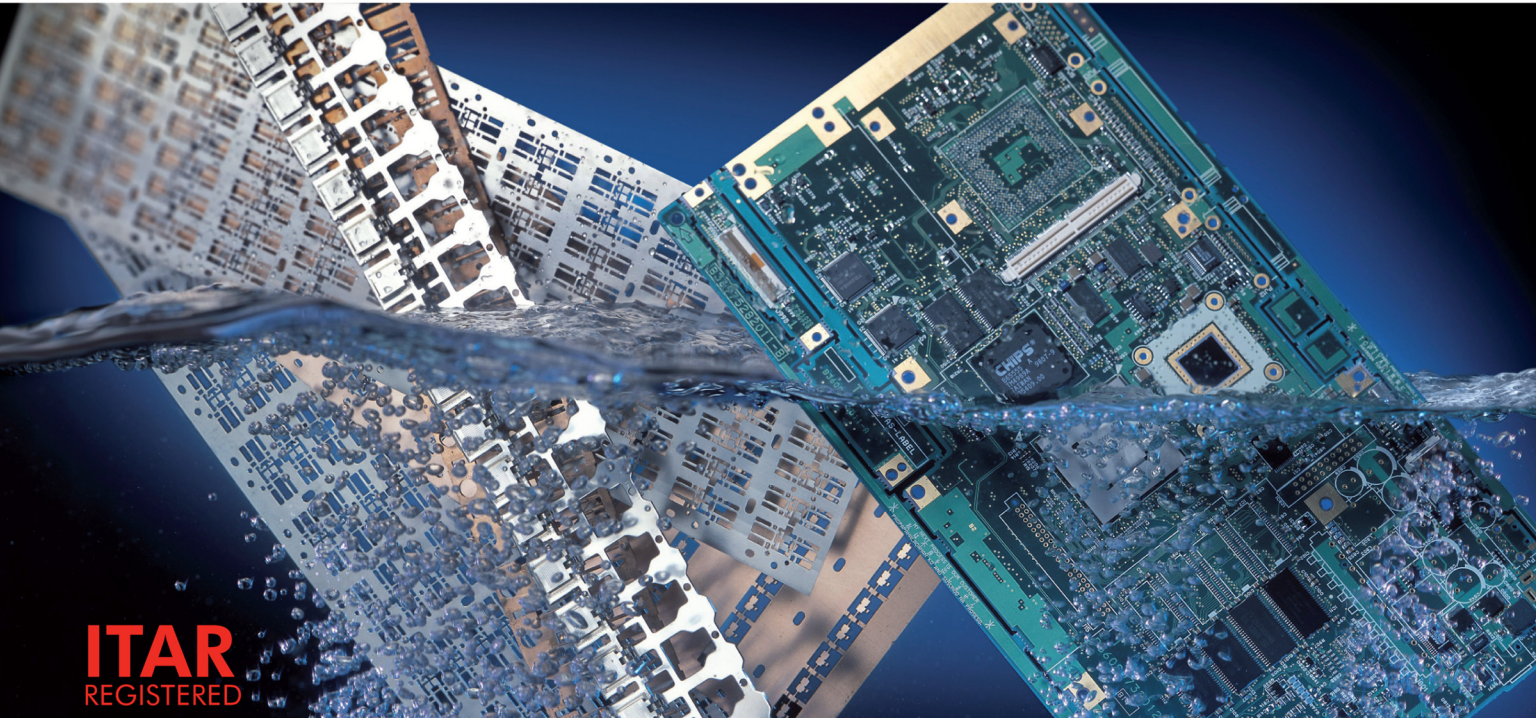
The course will explore a myriad of electroplating defects, such as mouse bites, pitting and domed or crown plating. Solderability and assembly related issues such as outgassing and blow holes will also be discussed. Participants should have some knowledge of the PCB fabrication process.

The course will conclude with a more thorough review of critical defects. The instructor will then present options for preventing these defects. The course presentation includes over 100 slides of defects.

### What you will learn:

- Lamination and other multi-layer related defects;
- Electrodeposition defects: Mouse bites, pitting, nodules, crown or dome plating, dog bone defects;
- Copper plating reliability
- How to improve plating distribution and throwing power;
- Metalization: Microvoids/voiding, interconnect separation, hole wall pullaway, Mglass coverage, metalizing; and
- High performance resins, wedge voids.

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## Bottom Terminal Components (QFN-SON) *Part 3:*

# PCB SURFACE FINISH OPTIONS AND RECOMMENDATIONS FOR SOLDER PRINTING

by Vern Solberg

### IN SUMMARY

In part two of his PCB Designers Notebook, industry expert Vern Solberg relates that for optimal thermal, electrical and board level performance, the exposed DAP on the package will need to be physically joined (by solder or thermally conductive polymer) to the thermal pad on the board.

As noted in Part 1 and 2 of this series, Quad Flat, No lead (QFN) and Small-Outline, No lead (SON) packaged semiconductors utilize conventional copper lead-frame technology. The QFN has bottom surface contact terminals on all four sides of the package while the SON package has contact terminals on only two sides. Package size is determined by several

key factors, including die size, number of contact terminals and contact pitch. There are five contact pitch variations defined in JEDEC Design Guidelines for the QFN and SON package families; 1.0 mm, 0.8 mm, 0.65 mm, 0.50 mm and 0.40 mm. As a note of caution: The length and width of the contact features can vary significantly between suppliers. Although users of these devices benefit from the low cost and relatively small outline of the package family, board level assembly remains a challenge.

In addition to providing a small outline, the SON and QFN package is designed to provide efficient thermal dissipation. This is achieved by incorporating an exposed die paddle (DAP) on the bottom surface of the package (Figure 1). To take full advantage of this feature, however, the PCB must also include surface features to effectively conduct heat away from the package. Additionally, to achieve optimum heat transfer from the metal “thermal pad” layer on the outer surface of





***In addition to providing a small outline, the SON and QFN package is designed to provide efficient thermal dissipation.***



the PCB to the inner or bottom layers it will be necessary to include plated thermal vias into the thermal pad design. The number of thermal vias needed will depend on the application, anticipated power dissipation and electrical requirements. For optimal thermal, electrical and board level performance, the exposed DAP on the package will need to be physically joined (by solder or thermally conductive polymer) to the thermal pad on the board.

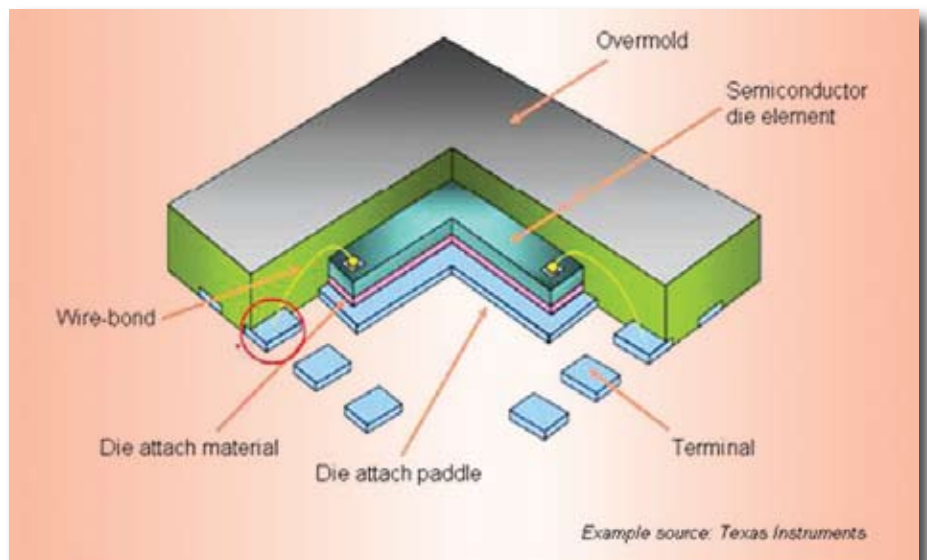
As noted in Part 2 of this series, the formation of the toe fillet (TF) for QFN and SON devices is not guaranteed because, after sawing or punch singulation, the bare copper ends terminals are prone to oxidation. It is generally observed, however, that the toe fillets may form depending whether the supplier has added an oxidation inhibitor or alloy plating to the exposed copper terminal ends. The toe fillet, if formed during assembly, may improve the solder joint reliability and allocation should be made for its formation. The type of solder paste used for board level assembly and environmental conditions for device storage is a factor as well.

In regard to defining the solder joint profile for the QFN and SON bottom terminal devices, the IPC-A-610E only states that: “The mounting and solder requirements for SMT terminations shall meet the criteria for the type of lead termination being used.” This statement is not really definitive, leaving the solder interface requirement open for agreement between the supplier and user. Many users, however, believe that to provide clearance for cleaning and to ensure a more robust solder mechanical interface of the device to the PCB, a target standoff dimension should be close to 50 microns (2 mils).

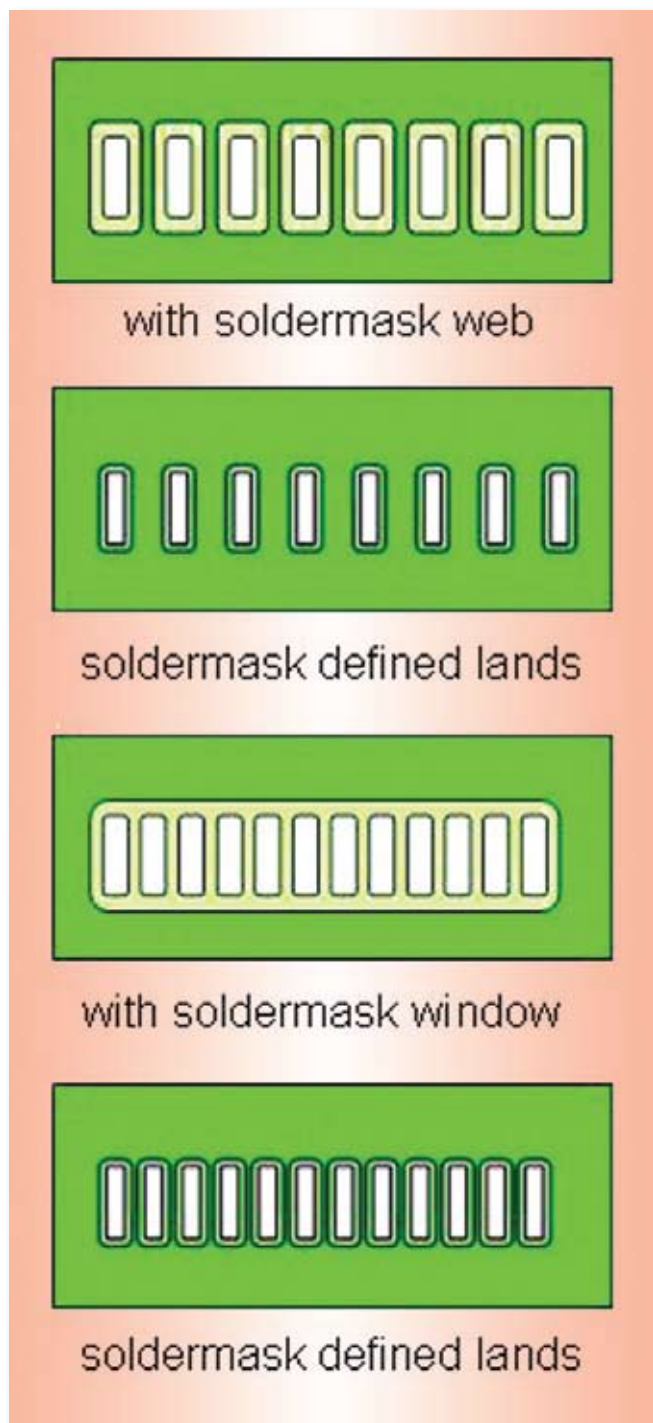
In specifying surface coatings on the circuit board, both soldermask and contact plating or oxidation inhibitors must be defined. Typically, each land on the

PCB should have its own soldermask opening with a web of mask between two adjacent pads. The land patterns and thermal pad(s) on the PCB will be either soldermask defined (SMD) or non-soldermask defined (NSMD). Since the copper etching process has tighter control than the solder mask application, NSMD lands are preferred over SMD lands. Also, NSMD pads with a soldermask opening larger than the metal pad size also improves the reliability of solder joints as solder is allowed to wrap around the sides of metal pads.

The solder mask opening should be 120 to 150 microns larger than the pad size, resulting in 60 to 75 micron clearance between the copper land pattern and soldermask. This will compensate for soldermask registration tolerances, which are typically between 50 to 65 microns, depending upon the board fabricators’ capabilities. To ensure robust adhesion, the soldermask “web” separating lands should be at least 75 microns in width. The 0.4 mm pitch package, however, with PCB land pattern width of 250 microns, a solder mask web between lands may not be practical. For this application it is recommended that the designer provide a single “window” opening around all land patterns on each side of the package with no solder mask in between the lands. The illustration furnished in Figure 2 compares four QFN/SON soldermask to land variations. When the clearance between the



**Figure 1:** QFN package assembly.



**Figure 2:** Comparing soldermask-to-land pattern variations.

perimeter contact lands and thermal pad is very close it is recommended that the thermal pad area be solder mask defined to avoid any solder bridging between the thermal pad and the perimeter pads. The mask opening should

be 100 microns smaller to overlap the thermal land perimeter on all four sides.

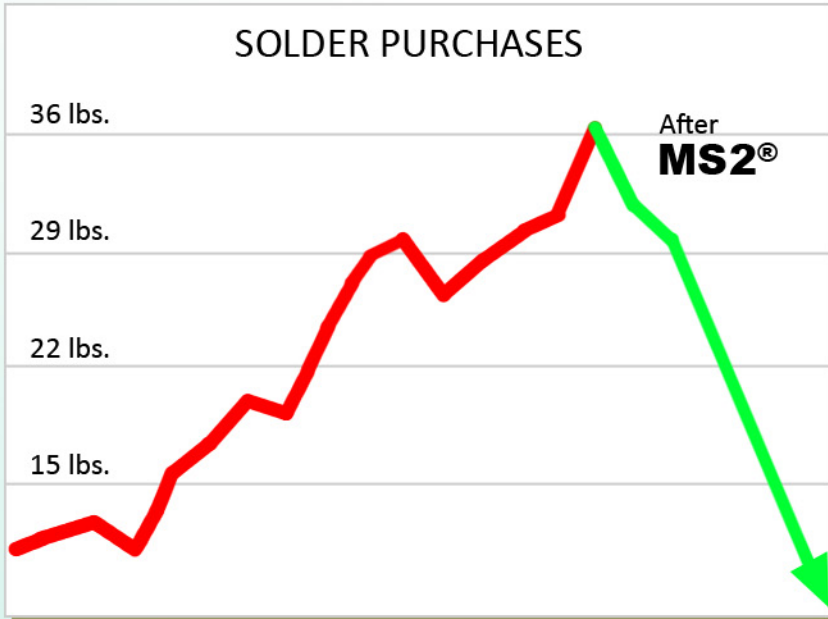
Because of the relatively small contact surface area, ensuring a robust solder interface requires a surface finish free of oxide coating and very precise solder paste print control. In regard to solder process compatibility, commercial QFN packages are available in two alloy finishes: Post plated Matte-Tin, and pre-plated Nickel-Palladium with a flash of Gold. The designer and process engineer will need to confer as to what will be the best surface finish on the attachment sites. Typical alternatives include Immersion Tin (IT), Immersion Silver (IS), Electroless Nickel/Immersion Gold (ENIG) or an Organic Solder Preservative (OSP) that coats the bare copper surface and inhibits oxidation. For an electroless nickel immersion gold finish, the gold thickness should be very thin to avoid solder joint embrittlement. Users suggest that for a PCB coated using a Hot Air Solder Leveling (HASL) process, the surface flatness should be controlled within 28 microns.

During the solder reflow process the printed solder paste will reach a liquidus state. While undergoing this process, the solvent and flux content in the paste is expelled to allow the remaining solids to join into a single mass on the thermal pad(s). The IPC-7093 recommends that to optimize the reliability of the solder joints on the perimeter lands, the thickness of solder paste furnished on the lands should be about 100 to 125 microns (4 to 5 mils). This volume of solder will result in a finished standoff dimension of around 50 to 75 microns (2 to 3 mils), respectively, after reflow soldering.

The first step in achieving good standoff is the solder paste stencil design for perimeter pads. The stencil aperture opening should be designed so that maximum paste release is achieved. This is typically accomplished by considering the following two ratios:

- 1. Area Ratio** = Area of aperture opening to aperture wall area.
- 2. Aspect Ratio** = Aperture width to stencil thickness.

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[CLICK HERE](#) to read *Economic and Technical Advantages of Chemical Dross Elimination and Prevention*, by Dan Feinberg.

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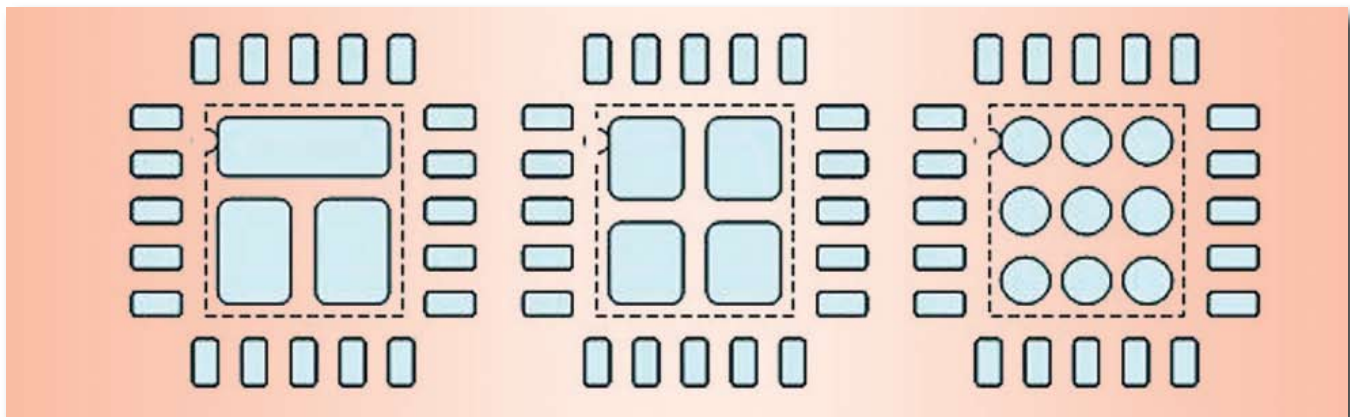


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**Figure 3:** Solder stencil aperture variations on thermal land.

For the rectangular aperture openings commonly required for QFN and SON package, ratios are given as Area Ratio =  $LW/2T(L+W)$ , and the Aspect Ratio =  $W/T$ , where “W” reflects the aperture width and “T” defines the stencil thickness. The stencil should be laser cut and electro polished. The polishing helps in smoothing the stencil walls resulting in better solder paste release during printing. It is also recommended that the stencil aperture tolerances should be tightly controlled to prevent excessive aperture size reduction, especially for 0.4 mm and 0.5 mm pitch devices. Although component suppliers may have a specific recommendation for solder paste print area-to-land area, a 1:1 stencil aperture to PCB land area is generally acceptable. The stencil opening can be reduced in length for the pullback terminal variations because of the smaller terminal area on the package.

As noted above, the QFN and SON packaged semiconductors may be furnished with an exposed DAP to transfer heat from the die element for dissipation into the circuit board. To effectively remove the heat from the package and to enhance electrical performance, the DAP needs to be physically joined to the PCB thermal pad. If solder is to be used for joining the thermal features it is recommended that, rather than one large opening matching the thermal pad outline, a smaller pattern of multiple openings on the thermal pad region be used. This will initially result in approximately 50% to 80% printed solder paste coverage.

Shown in Figure 3 are some of the ways to achieve these reduced levels of coverage. In regard to the solder reflow process, many have observed that the lead-free, Tin-Silver-Copper (SAC) alloys have very different wetting and capillary characteristics than those of the eutectic Tin-Lead (Sn-Pb) alloy compositions. The SAC alloy, while in its liquidus form, does not exhibit the same flow or migration across the land and onto the component terminals as the Sn-Pb alloy. In addition, the self-centering and self-aligning phenomena of smaller components normally experienced during the Sn-Pb solder process cannot be assumed. On the other hand, because the melted solder flow is contained within the area where printed, bridging between closely spaced features or into adjacent plated via holes will be minimal.

The information conveyed in this three-part series is only an overview of the very detailed guidance available in the new IPC-7093, Design and Assembly Process Implementation for Bottom Termination Components document. **SMT**



About the Author: Vern Solberg is an independent technical consultant specializing in surface mount and microelectronic design and assembly process development.

He may be contacted at (408) 568-3734; [vsolberg123@aol.com](mailto:vsolberg123@aol.com).

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## IPC's Electronics Market Data Update Shows Recovery

Economically, 2010 was a better year than expected in most parts of the world. Although Japan experienced exceptionally high growth in 2010, this was the year that China overtook Japan to become the second-largest world economy after the U.S. There are now strong indications that most economies around the world have fully recovered from the 2008–2009 recession. Most electronics industry segments are still experiencing strong, but slowing, growth. Markets are returning to normal. Data on these trends in specific industry segments and regions is covered in the recently released winter 2011 edition of IPC's quarterly business report, *Electronics Industries Market Data Update*.

Most segments of the electronic interconnect supply chain worldwide posted double-digit year-on-year growth in the fourth quarter of 2010. PCB assembly equipment, laminate, EMS and process consumables led the pack. Sales in most industry segments have returned to pre-recession levels.

In North America, the top performers in year-on-year growth for fourth quarter

2010 were PCB assembly equipment, flexible circuits and the EMS industry. The IPC Index of North American Electronics Industry Performance®, a composite of sales growth for major industry segments and leading economic indicators, shows the recovery cycle ending and a return to normal growth. The index for the fourth quarter of 2010 stood at 16.5, down from 31.0 in the third quarter, but still solidly positive.

Subscribers to the *Electronics Industries Market Data Update* also have access to an interactive graph built upon the index data and showing growth trends back to 2007. Users can add their own companies' quarterly year-on-year growth rates to the data table and see a line graph showing how their company has been performing in comparison to their industry segment as well as customer and supplier industries.

The report is free to all IPC members and can be accessed online, via a log-in page, at [www.ipc.org/Update](http://www.ipc.org/Update). For more information on this report or on IPC's market research services, contact [SharonStarr@ipc.org](mailto:SharonStarr@ipc.org), IPC Director of Market Research, at +1 847-597-2817.

## NEPCON China Set to Highlight Growth in Region

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# PRINTING AND ASSEMBLY CHALLENGES FOR QFN DEVICES

by **William E. Coleman, Ph.D.**  
PHOTO STENCIL

## IN SUMMARY

William E. Coleman examines the assembly and printing challenges associated with QFNs and DFNs, which are becoming more popular in new component releases. Their very small form factor allows smaller packages, better grounding and better heat sink thermal properties compared to other SMT packages.

### Benefits and Challenges

Quad flat packages, no leads (QFNs) and dual flat packages, no lead (DFNs) are becoming more popular in new component releases. Their very small form factor allows smaller packages, better grounding and better heat sink thermal properties compared to other

SMT packages. Most QFNs have a metal pad on the underside of the part for grounding and heat conduction. DFNs have a similar center metal pad, but have leads on only two sides. Typical thickness of the QFN devices is 0.85 mm and the body range from 3 mm up to 12 mm, so the packages are very small and very light. The QFN leads and ground plane conductor are flat and in the same plane on the bottom of the package.

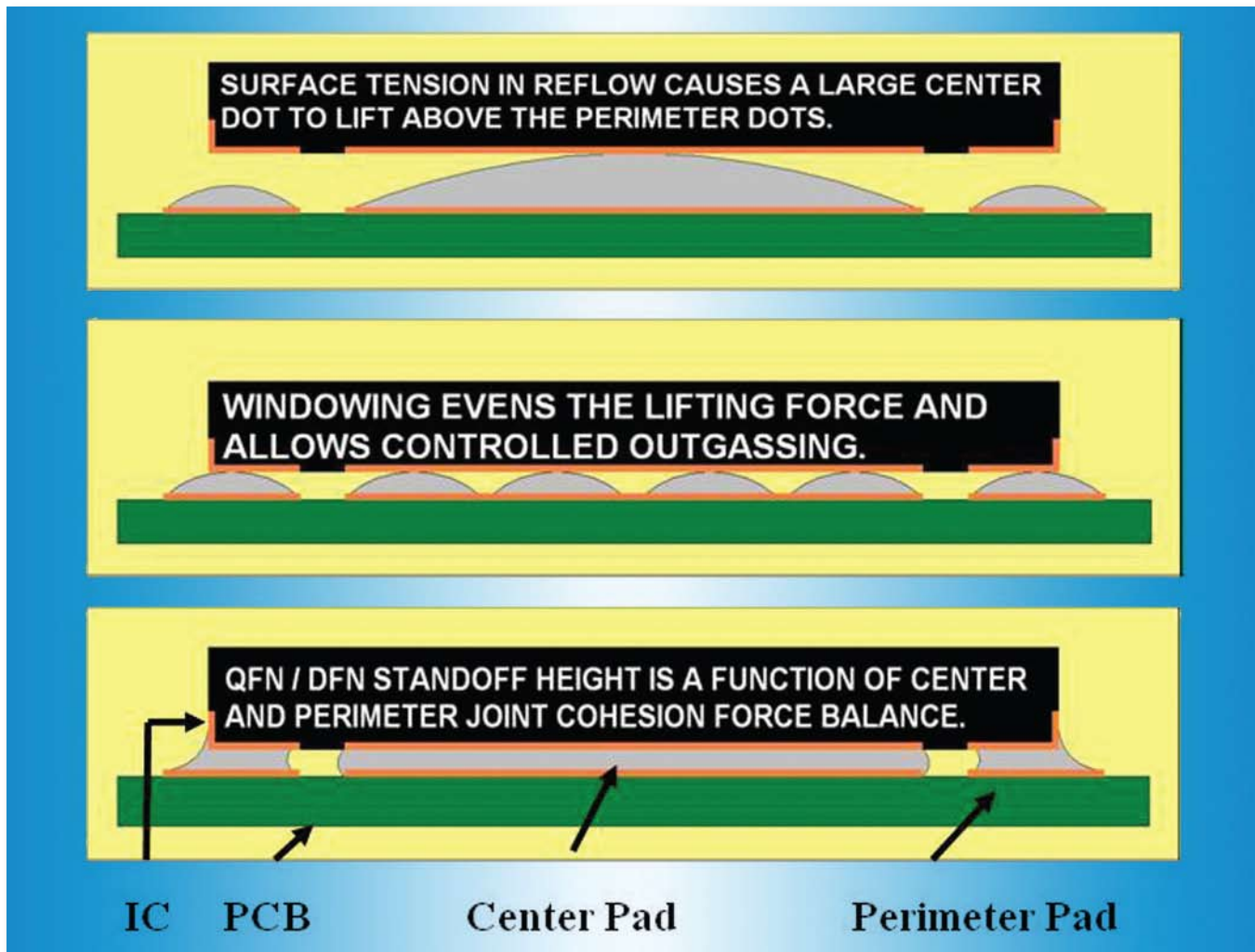
Printing solder paste 1-1 with the ground plane can cause the QFN to float during reflow, thus miss-registering the leads on the QFN and the pads on the PCB. QFN float can be controlled by reducing the amount of solder paste printed on the ground plane. Typically a 50 to 60% reduction will solve the QFN float problem. However, the aperture reduction must be performed judiciously. A window pane aperture is recommended for most cases. This allows the solder paste volatiles to easily escape during reflow without moving the QFN device. Figure 1 shows the benefits of window pane apertures for the ground plane.



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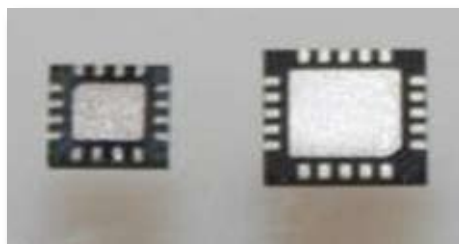
*Their very small form factor allows smaller packages, better grounding and better heat sink thermal properties compared to other SMT packages.*

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**Figure 1:** Benefit of window pane ground plane apertures.

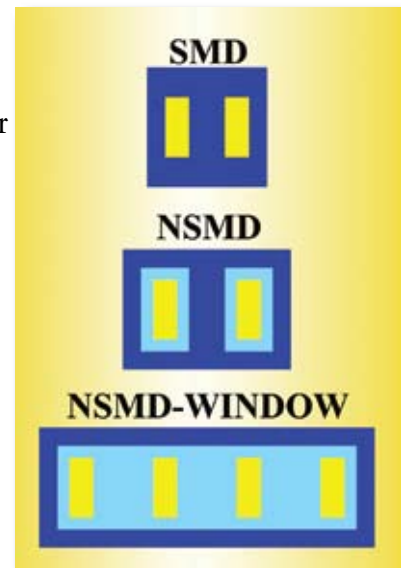
The next challenge is the actual aperture size in the stencil. Figure 2 shows a 3 mm QFN and a 4 mm QFN device. Typical aperture widths as low as 0.175 mm, and aperture lengths as low as 0.4 mm, present a challenge to the printing process as far as percent paste transfer. The other challenge is the solder mask employed on the PCB. The three types of solder mask design, which are shown in Figure 3, are:



**Figure 2:** 3 and 4 mm QFN devices.

1) SMD where the pad opening on the board is defined by the solder mask; 2) NSMD

where the pad itself defines the boundary of the pad and the solder mask is pulled back off the pad (typically 0.05 to 0.075 mm per side); and 3) NSMD -Window. In the last case, there is no solder mask between pads so bridging between pads is more likely than with solder mask between pads.



**Figure 3:** Solder mask designs.

STENCIL DESIGN FOR TYPICAL QFN APERTURES (NSMD):										
Package	Pitch	I/O	Package lead width	Package lead length	PCB	PCB	Aperture NSMD	Aperture NSMD	Stencil Thickness	Area Ratio
3mm	.5mm	12	.23mm	.55mm	.23mm	.75mm	.23mm	.75mm	.125mm	0.70
4mm	.5mm	20	.25mm	.40mm	.25mm	.60mm	.25mm	.60mm	.125mm	0.71
7mm	.5mm	44	.25mm	.55mm	.25mm	.60mm	.25mm	.60mm	.125mm	0.71
10mm	.5mm	72	.23mm	.40mm	.25mm	.60mm	.25mm	.60mm	.125mm	0.71
12mm	.5mm	80	.25mm	.55mm	.25mm	.75mm	.25mm	.75mm	.125mm	0.75

STENCIL DESIGN FOR TYPICAL QFN APERTURES (SMD):										
Package	Pitch	I/O	package lead width	package lead length	PCB	PCB	Aperture SMD	Aperture SMD	Stencil Thickness	Area Ratio
3mm	.5mm	12	.23mm	.55mm	.23mm	.75mm	.18mm	.70mm	.125mm	0.57
4mm	.5mm	20	.25mm	.40mm	.25mm	.60mm	.20mm	.55mm	.125mm	0.59
7mm	.5mm	44	.25mm	.55mm	.25mm	.60mm	.20mm	.55mm	.125mm	0.59
10mm	.5mm	72	.23mm	.40mm	.25mm	.60mm	.20mm	.55mm	.125mm	0.59
12mm	.5mm	80	.25mm	.55mm	.25mm	.75mm	.20mm	.70mm	.125mm	0.62

STENCIL DESIGN FOR TYPICAL QFN APERTURES (NSMD WINDOW):										
Package	Pitch	I/O	package lead width	package lead length	PCB	PCB	Aperture SMD	Aperture SMD	Stencil Thickness	Area Ratio
4mm	.4mm	28	.175mm	.45mm	.175mm	.710mm	.175mm	.710mm	.125mm	0.56
4mm	.4mm	28	.175mm	.45mm	.175mm	.710mm	.175mm	.710mm	.100mm	0.70

**Table 1:** QFN, PCB, stencil design guidelines.

**Stencil and PCB Design Considerations**

Table 1 shows stencil design guidelines for the three solder mask cases. This table shows the package size, the lead pitch, the number of I/O, the package lead dimensions, the recommended PCB pad dimensions, the recommended stencil aperture dimension, recommended stencil thickness and resulting Area Ratio. For NSMD, the stencil aperture is 1-1 with the PCB pad dimension. It should be noted that the recommended length of the pad on the PCB compared to the length of the lead on the QFN is 0.2 mm larger. As seen, the Area Ratio for a 0.125-mm-thick stencil is >0.66 for all the examples listed. Aperture size for the SMD is 0.05 mm smaller than the PCB pad.

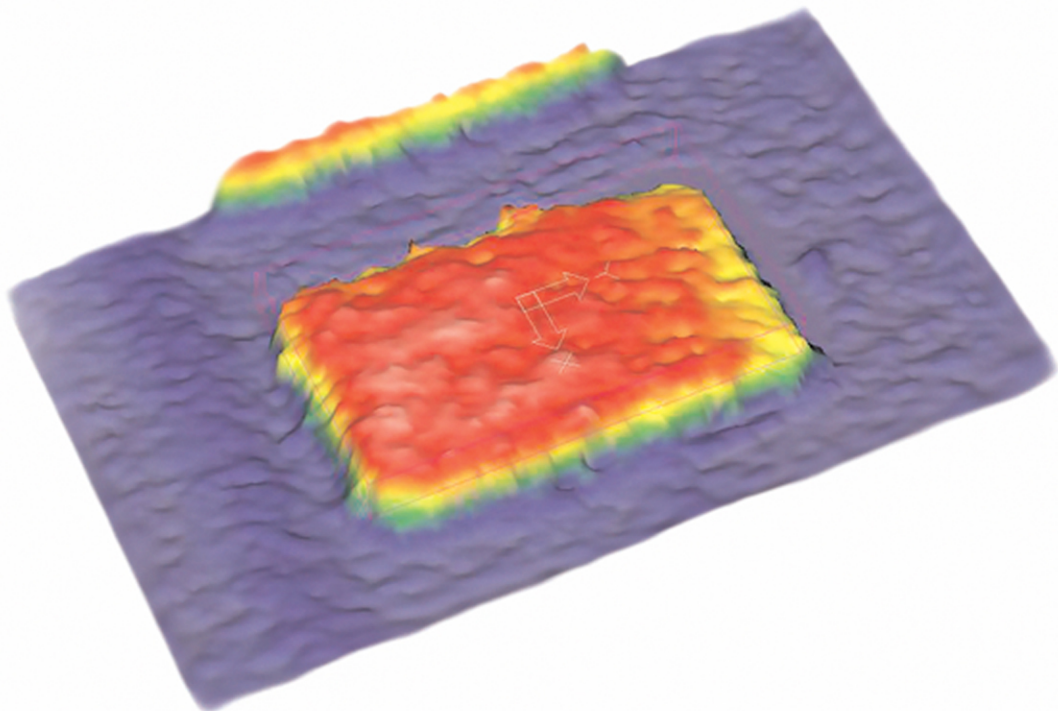
There are typically two reasons for this reduction. If the stencil is slightly misaligned to the PCB, paste could be printed on the solder mask. Also, there might be high stress points if solder contacts the mask. The reduction in aperture size has reduced the Area Ratio making paste transfer more difficult. For Area Ratios below 0.66, electroform stencils or nano-coated stencils are normally recommended. The final example in Table 1

is the NSMD-Window. The pitch is 0.4 mm, leaving little room to put solder mask between pads on the PCB. Aperture size is also small, giving a challenging Area Ratio for 0.125-mm-thick stencils; therefore, 0.100-mm-thick stencils are normally recommended to provide a more robust stencil printing process window.

Another problem that arises when using a NSMD-Window is when the solder mask is higher than the pad on the PCB. In this case, the solder paste is extruded through the stencil since the stencil is not in contact with the PCB pads during printing. This extruded paste will make contact with the bottom side of the stencil causing potential bridging during successive prints since there is no solder mask between neighboring pads. Stencil wiping after every print may help reduce this problem. An Example of a NSMD-Window PCB with the solder mask above the height of the PCB pads is shown in Figure 4. One possible solution suggested by a customer [1] is a PCB side step stencil as shown in Figure 5. This is an electroform stencil which is 0.08 mm thick everywhere except in the QFN area inside the solder mask, where it is 0.01 mm thick. In

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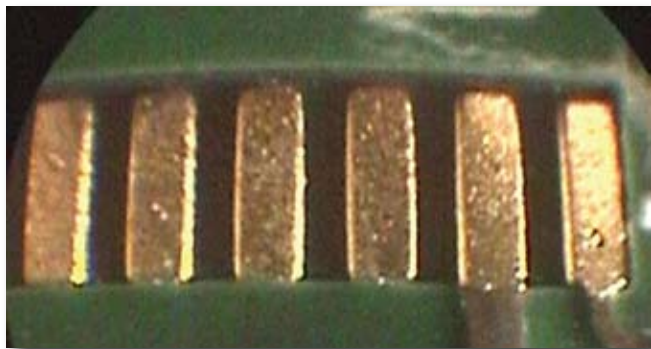
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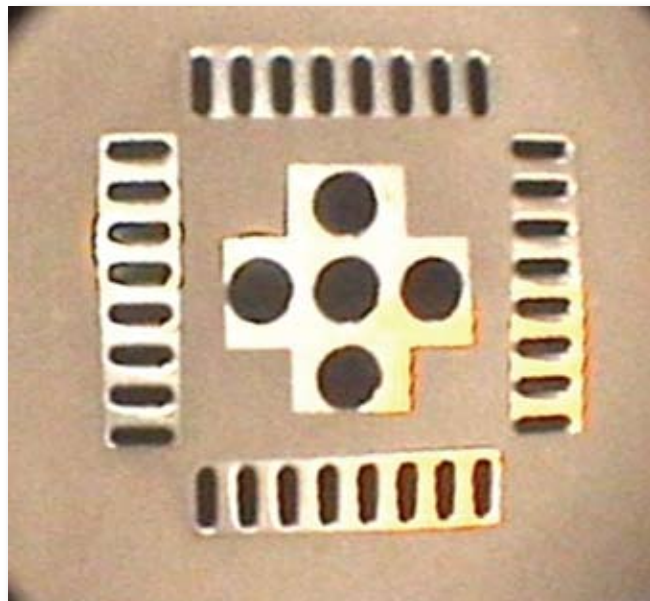
**Figure 4:** NSMD-Window with mask to pad gap of 0.03 mm.

this case the mask opening was of the order of 0.125 mm per side except on the ends of the pad rows where it was less. There are several limitations to this approach, namely the spacing between the step and the solder mask is extremely small, allowing for little miss-registration. Also, the stencil is thinner for all other components except the QFNs, which may yield insufficient paste. The first limitation could be addressed at the PCB design level by making the mask to pad clearance much larger, of the order of 0.25 mm per side, as well as leaving the ground plane without any solder mask surrounding.

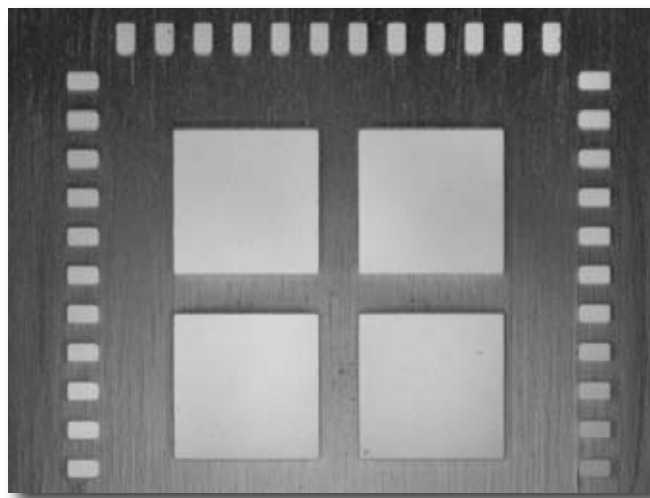
Another possible solution is a single level stencil without step, but with nano-coating on the aperture walls, as well as on the bottom side (PCB side) of the stencil. Nano-coatings have a property called fluxophobicity. Quite simply, it is the stencil's ability to resist the spread of flux on its surface. It is measured in the form of the "flux contact angle." This is the angle that the flux will form when a drop is placed on the surface of the stencil. Nano-coating not only increases the paste ability to release from the apertures, but also to resist spreading on the bottom side of the stencil when the paste is extruded into a cavity created by the NSMD-Window. This property not only eliminates the need for frequent under board wiping, but also reduces the occurrence for pad to pad bridging.

### QFN Repair

The first step to repair a defective QFN device is to remove the defective device from the PCB and clean the excess solder from the



**Figure 5:** Step electroform stencil on PCB side, 0.01 mm thick around QFN apertures and 0.08 mm elsewhere for all other apertures.



**Figure 6:** QFN repair stencil with window pane ground plane apertures.

PCB pads. Solder paste is then printed either on the PCB or on the bottom of the QFN prior to placing the QFN on the PCB and locally heating to reflow the solder paste and solder the device in place. Mini stencils are normally used to print paste on the PCB. This can be a difficult and tedious task for very small QFN devices ranging in size from 3 mm up to 12 mm. Printing solder paste directly onto the QFN device is a more popular approach [2].

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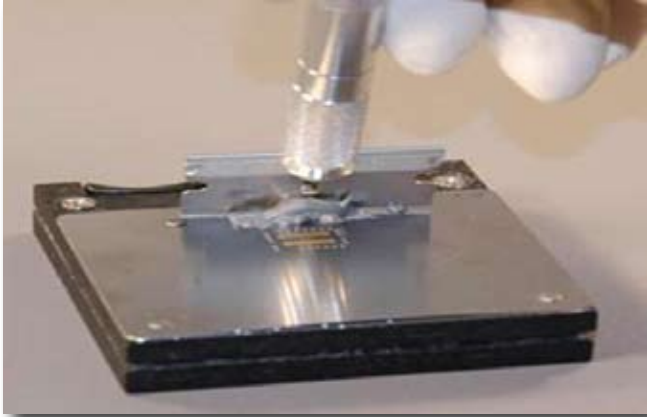
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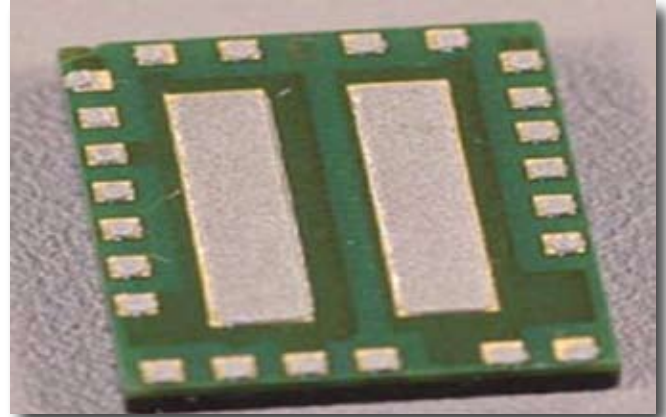
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**Figure 7:** Printing solder paste on QFN device while in holding tool.



**Figure 8:** Solder paste printed on QFN before placement on PCB for rework.

Figure 6 shows a repair stencil that fits into a holding tool which also holds the QFN in registration to this stencil. The top portion of a 7 mm/48 I/O 0.5 mm pitch repair stencil and the top portion of a 10 mm/72 I/O 0.5 mm pitch repair stencil are shown. Note that the aperture area for the ground plane is reduced by approximately 50% by the window pane technique.

Figure 7 shows paste printed on QFN pads using the tool that holds both the stencil and the QFN device. Figure 8 shows paste on the same QFN. After paste is applied, the QFN is placed on the PCB and locally reflowed.

### Conclusion

Although QFN devices present a challenge to the SMT assembly process with proper stencil design, proper stencil technology selection (laser, electroform, nano-coat) and proper PCB solder mask layout, these challenges can be overcome. The most popular QFN repair seems to be to print solder paste directly onto the QFN leads and ground plane. **SMT**

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1. Private communication with Greg Kloiber, Manufacturing Engineer, Plexus Corp.
2. William E. Coleman, "BGA and QFN Repair Process," IPC APEX Expo, 2008.

### General QFN References:

1. James R. Staley, "Rule of Thumb Guide for Practical DFN/QFN Printed Circuit Board and Stencil Design," James R. Staley, Linear Technology application note.
2. "PCB Land Pattern Design and Surface Mount guidelines for QFN Packages," Intersil Technical Brief TB389.6.
3. "QFN Layout Guideline," Texas Instrument Application Report SLOA122.



Dr. William E. Coleman earned his Ph.D. in Physics from West Virginia University. His early career was spent with NCR developing memory and visual display devices. Dr. Coleman has spent the past 23 years at Photo Stencil as Vice President of Technology working closely with customers to understand their SMT printing requirements. At Photo Stencil he has developed several innovative solutions for these requirements. Dr. Coleman has published over 20 papers in this field and is presently Co-Chair of IPC 5-21e committee, which produced IPC 7525 "Stencil Design Guidelines." He is on the Editorial Advisory Board for **SMT** Magazine and the Advisory Board for West Virginia University.



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# PROCESS OPTIMIZATION TO PREVENT THE GRAPING EFFECT

by **Ed Briggs and Ron Lasky**  
INDIUM CORPORATION

## IN SUMMARY

The miniaturization trend has put a considerable strain on the electronic assembly industry. Here, the authors discuss the specific challenge of the Graping Effect and the work performed to mitigate this phenomenon. Discussed are the effects of the solder paste material attributes, consistent stencil printing of the small solder paste deposits required and minimizing oxidation of the small solder paste deposit during reflow.

### Introduction

The explosive growth of personal electronic devices, such as mobile phones, personal music devices and tablets, has driven the need for smaller and smaller active and passive electrical components. Not too long ago, 0401 (40 x 10 mils) passives were seen

as the ultimate in miniaturization, yet the introduction of 0201s and, most recently, 01005 passives has occurred. For active components, area array packages with 0.4 mm lead spacing have become virtually a requirement for enabling the many features in modern portable electronic devices, with 0.3 mm packages already on the way.

This miniaturization trend, occurring at the same time as the conversion to RoHS compliant lead-free assembly, has put a considerable strain on the electronic assembly industry. This paper will discuss the specific challenge of the Graping Effect and the work that has been performed to mitigate this phenomenon. Discussed are the effects of the solder paste material attributes, consistent stencil printing of the small solder paste deposits required and minimizing oxidation of the small solder paste deposit during reflow. All of these steps are necessary to assure a good finished solder joint.

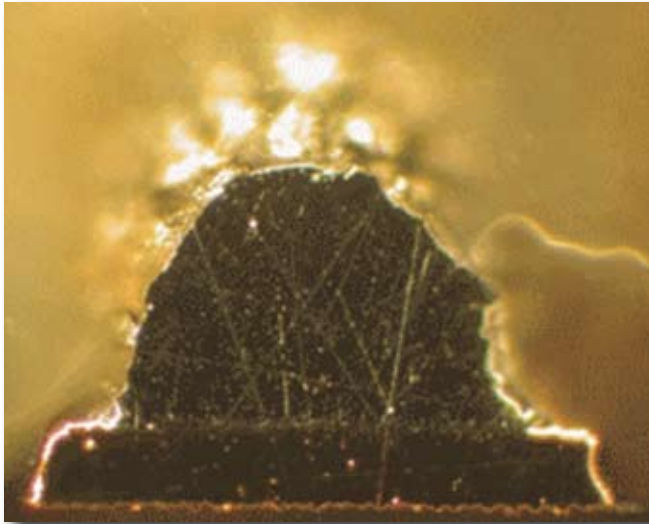
### Graping Phenomenon

As the solder paste deposit decreases in size, the relative surface area of exposed





*This miniaturization trend, occurring at the same time as the conversion to RoHS compliant lead-free assembly, has put a considerable strain on the electronic assembly industry.*



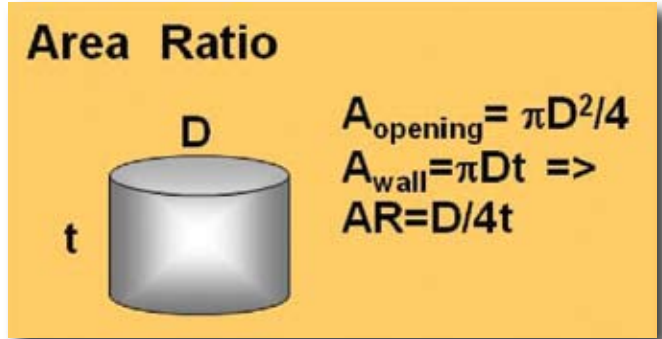
**Figure 1:** Graping effect.

solder particles increases and the amount of available flux to remove surface oxide decreases. Add to this the added heat necessary to reflow most lead-free solders and you have a formula conducive to producing the graping phenomenon. During the heating process, the flux viscosity decreases and the flux begins to spread downward and outward, exposing the solder particles at the top of the paste deposit. With no protecting flux, these solder particles may become oxidized as the paste enters into the actual solder reflow stage. These oxides will inhibit the full coalescence of the particles into the solder joint. The unreflowed particles often exhibit the appearance of a cluster of grapes.

## Stencil Printing

### Area Ratio

The area ratio (AR) is a critical metric in successful stencil printing. It is the area of the stencil aperture opening divided by the area of the aperture side walls. Figure 1 shows a schematic for a circular aperture. A simple calculation shows that the area ratio (AR) is simplified to the diameter (D) of the circle divided by 4 times the stencil thickness (t):  $AR = D/4t$ . The result is the same for square apertures, with D now equal to the sides of the square. For the AR of a rectangular aperture, the formula is a little more complicated:  $ab/2(a+b)t$ , where a and b are the sides of the rectangle.



**Figure 2:** A schematic showing the definition of the area ratio for a circular stencil.

It is widely accepted in the industry that to get good stencil printing the AR must be greater than 0.66. Experience has shown that if  $AR < 0.66$ , the transfer efficiency will be low and erratic. Transfer efficiency, another important stencil printing metric, is defined as the volume of the solder paste deposit divided by the volume of the aperture.

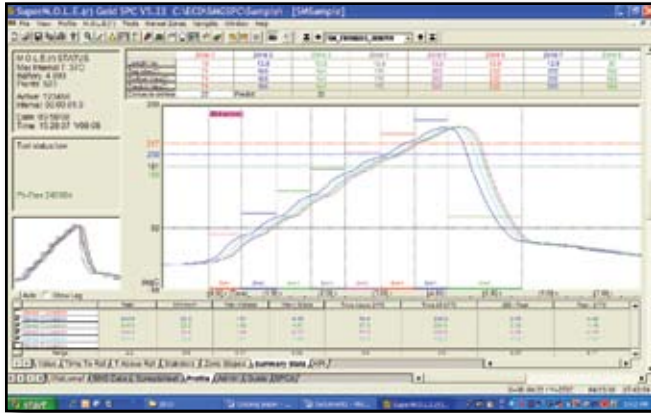
### The Experimental Design

To investigate ways to minimize graping we performed experiments designed to assure the previous guidelines with respect to area ratio and transfer efficiency have been followed. In addition, we wanted to observe the effect of solder paste material attributes, specifically particle size and flux chemistry, in both water-soluble and no-clean solder pastes, as well as

<i>Powder Size</i>		
<i>TYPE</i>	<i>Diameter Range microns</i>	
<b>3</b>	<b>25</b>	<b>45</b>
<b>4</b>	<b>20</b>	<b>38</b>
<b>5</b>	<b>15</b>	<b>25</b>
<b>6</b>	<b>5</b>	<b>15</b>

**Figure 3:** Types 3, 4, 5 and 6 particle size powders were used in both water-soluble and no-clean chemistries.

the effect of the reflow profile on the graping phenomenon. Therefore, in an effort to reduce the number of variables, the same stencil, squeegee blades, printer parameters and PWB surface were used.



**Table 1:** Table Ramp-to-peak profile (242°C peak and 60 seconds time-above-liquidus).



**Table 2:** Soak profile (110 second soak at 190-210°C, 242°C peak and 60 seconds time-above-liquidus).

A 3mil laser cut/electropolish stencil, 200 mm squeegee with edge guards, foiless clamps and landscape vacuum support blocks were optimized on the stencil printer. Each solder paste was printed at 50 mm/second with a blade pressure of 4kg.

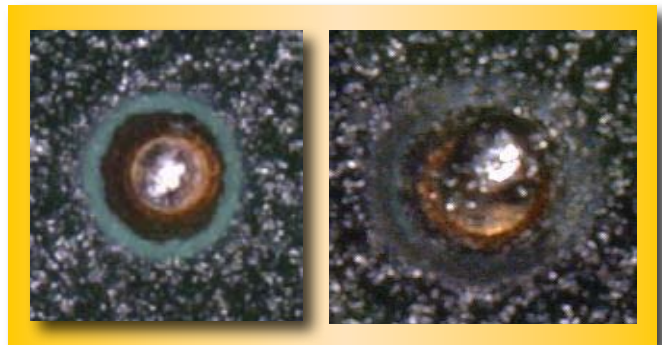
A test board including 6mil circles and squares in both solder mask defined (SMD) and non-solder mask defined (NSMD) pads on a Cu OSP surface finish were the focus of observation.

## Results

### Particle Size

To accommodate fine feature stencil printing it is not uncommon to look at finer powder solder pastes to optimize the printing process. However, as the size of the powder particles within the solder paste decreases, the relative amount of surface area exposed increases. With this increase in surface area, an increase in total surface oxides is also introduced. This increase in surface oxides requires the flux chemicals to work even harder at removing the oxides and protecting the surfaces during the rest of the reflow process, as seen above.

For the same profile, the graping phenomenon increases as the particle size decreases.



**Figure 4:** Typical results—Type 3 (left) versus Type 6 (right) using the same no-clean flux chemistry and reflow profile (RTP).

### Water-Soluble Versus No-Clean

No-clean flux chemistries are generally rosin/resin-based (hereafter referred to only as resin) formulas. Because resins are not very soluble in the solvents used in water-soluble flux chemistries, they are typically replaced with large molecular compounds such as polymers in water-soluble fluxes. The activator(s) within the flux chemistry removes the current oxides on the joining surfaces, as well as the solder paste particles within the solder paste itself. Further oxidation/re-oxidation does occur during the heating stage. Whereas, in no-clean fluxes the resins are excellent oxidation barriers and protect against



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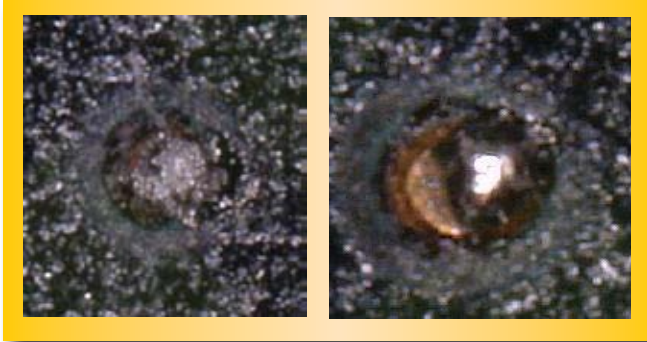
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re-oxidation, the lack of resins in water-soluble chemistries cause them to fall short in providing that same oxidation resistance.

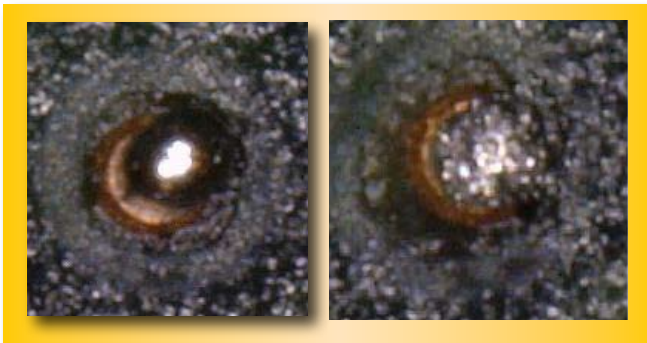
Hence, for the same reflow profiles, though water-soluble chemistries are generally more active, the lower oxidation resistance of water-soluble chemistries makes them more sensitive in long and/or hot profiles, increasing the graping defect.



**Figure 5:** Typical results—Water-soluble (left) versus no-clean (right) using the same Type 6 powder size and reflow profile (RTP).

### **Ramp-to-Peak (RTP) Versus Soak**

In the past, the “soak type” reflow profile was very prevalent, but focus has shifted to RTP as the preferred reflow profile. Contributing to this shift is the introduction of higher reflow temperatures associated with lead-free solders and the need to diminish the total heat exposure of the smaller paste deposits and temperature sensitive components. Another benefit of the soak profile was its utilization to reduce voiding; however, it is not as effective with lead-free



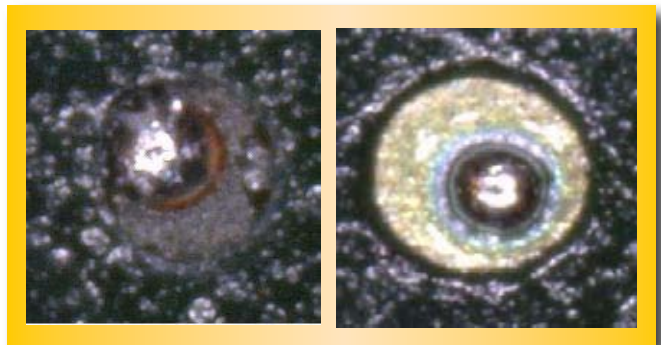
**Figure 6:** Typical results—RTP profile (left), soak profile (right) using the same Type 6 powder size and flux chemistry (no-clean).

solders due to the increased surface tension of these solders and the higher temperatures used to reflow them.

To minimize graping, the shorter the time in the oven the better, provided you use the same time-above-liquidus and peak temperature. The soak profile typically produces more of the graping phenomenon than RTP profile. The graping effect is exacerbated as the total time in the oven increases. Decreasing the total heat dramatically decreases the graping affect. A ramp rate (from ambient to peak) of 1°C/second is recommended, which equates to about 3 minutes 40 seconds to a peak temperature of 245°C.

### **SMD Versus NSMD**

Results of the experiments using solder masking show that for the solder mask defined pads the graping effect was less prevalent. It is believed that the solder mask provides a dam which restricts the spread of the flux during the heating process so that it does not “run away” as easily, increasing the potential availability of the flux to remove oxides.



**Figure 7:** Typical results—Non-solder mask defined pad (left), solder mask defined pad (right) using the same Type 6 powder size, flux chemistry (no-clean) and reflow profile (RTP).

### **Square Aperture Versus Round Aperture**

The area ratio for a 6mil square and circular apertures on a 3mil thick stencil equals 0.50. In comparing the two, however, the volume for the square solder paste deposit is greater (~108 cubic mils) than the circular deposit (85 cubic mils). The additional paste volume provided by the square aperture may help



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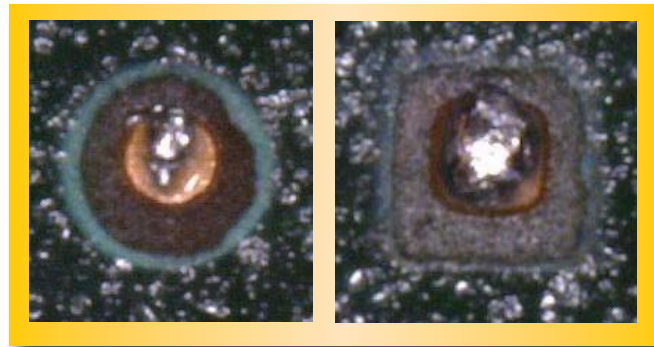


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reduce the graping phenomenon. Of greater importance, though, is the increased transfer efficiency provided by the square aperture. As shown above for both solder mask defined and non solder mask defined pads of the same area ratio, the square aperture design provides more consistent transfer efficiency, reducing the potential for the graping phenomenon.



**Figure 8:** Typical results—Circular aperture/pad (left), square aperture/pad (right) using the same Type 3 powder size, area ratio, flux chemistry (no-clean) and reflow profile (RTP).

Component ID	A.R.	T3- 88.75%	T4- 88.50%	T5- 88.75%	T3- 89.00%	T4- 88.75%	T5- 88.50%
C6 SMD	0.50	39	38	47	44	43	51
S6 SMD	0.50	50	50	56	53	53	58
C6 NSMD	0.50	24	31	34	33	30	47
S6 NSMD	0.50	41	45	50	49	46	58

**Table 3:** Transfer efficiency comparing 8mil circle versus 8mil square aperture design.

**Conclusion**

To reduce the graping effect, it is vital to ensure an optimal printing and reflow process. Using the guidelines provided for the area ratio and good process/equipment set-up will ensure good transfer efficiency. From a reflow standpoint, decreasing the total heat input will decrease the likelihood of the effect. Using a RTP type profile with a ramp rate of ~1°C/second is suggested.

Material factors also influence the outcome, with an increase in the observance of graping as the solder paste particle size decreases and the area of surface oxides increase. Water-soluble solder paste chemistries do not provide the oxidation barrier that resins do for no-clean chemistries and are more prone to the graping effect.

Though the area ratio for circular and square aperture designs may be equal, the potential for the graping phenomenon increases with circular aperture designs due to decreased paste volume and decreased transfer efficiency.

Though not performed in this experiment, but observed with customer evaluations, the use of nitrogen does diminish or eliminate this effect. **SMT**



Dr. Lasky is a Senior Technologist at Indium Corporation and a Visiting Professor at Dartmouth College. Additionally, he has over 20 years experience in electronic and optoelectronic packaging at IBM, Universal Instruments and Cookson Electronics. Dr. Lasky has authored or edited five books on science, electronics and optoelectronics and numerous technical papers. He has also been an adjunct professor at several colleges and has taught over 20 different courses on topics ranging from electronic packaging, materials science, physics, mechanical engineering and science and religion.



Ed Briggs is a Technical Support Engineer with Indium Corporation where he has worked for over 19 years. He has an AS Degree in Chemical Technology from Mohawk Valley Community College where he won the Douglas J. Bauer Award for Excellence in Chemistry. He is an SMTA-certified engineer and has earned a Green Belt Six-Sigma Certification from Dartmouth College for demonstrated proficiency in developing and executing design experiments to support continuous process improvement. Briggs is also certified as an IPC-A-600 and IPC-A-610D specialist.

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# WAITING FOR RECAST RoHS?

## Don't Forget U.S. Requirements that Apply to Semiconductor and PCB Manufacturers

by Jean-Cyril Walker

### IN SUMMARY

Importers and manufacturers in the U.S. are increasingly being asked by downstream customers to provide products, including component parts that are safe, "environmentally-friendly" and free of a host of substances that may or may not be regulated. This article presents a top-level summary of those requirements.

As we reported in the February issue, the European Parliament has approved the recast of Directive 2002/95/EC on the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment (RoHS). The European Council's formal adoption is expected within the next couple of months, after which the recast Directive will enter into force 20 days later. While awaiting final adoption of the recast RoHS Directive and considering the business implications, semiconductor and circuit board manufacturers should not forget

the U.S. laws that also potentially impact their products and operations.

Over the past few years, the U.S. has experienced significant growth in laws and regulations governing manufactured products, particularly at the state level. This increased activity likely stems from an expanded focus on the safety and environmental performance of consumer products by environmental and consumer advocates as a means of driving regulatory requirements down the supply chain. As a result, importers and manufacturers in the U.S. are being asked by their downstream customers to provide products, including component parts that are safe, "environmentally-friendly" and free of a host of substances that may or may not be regulated. This article presents a top-level summary of the U.S. requirements. For ease of review, the discussion is organized around the product life cycle.

#### ***1. Manufacture, Importation and Processing***

##### **A. Toxic Substances Control Act**

The Toxic Substances Control Act (TSCA) provides the U.S. Environmental Protection Agency (EPA) with broad authority to regulate the manufacture, importation, process-





*Over the past few years, the U.S. has experienced significant growth in laws and regulations governing manufactured products, particularly at the state level.*



ing, distribution, use or disposal of “chemical substances in the U.S. [1]” While, generally speaking, circuit board and semiconductor manufacturers are not in the “chemicals business,” a variety of discrete activities could bring them within TSCA’s reach. These include importing chemicals for use in manufacturing such products, processing chemicals subject to significant new use rules [2], producing and/or recycling byproducts for a commercial purpose [3] and manufacturing or importing small amounts of specialty degreasers, lubricants or cleaning solutions.

TSCA imposes a variety of reporting and recordkeeping obligations on manufacturers, importers and, in some instances, processors related to chemical production, use, and health and safety information. Penalties for TSCA violations are significant, up to \$37,500 per chemical per day. Because TSCA is a “strict liability” statute, EPA can assess penalties without regard for whether the company was negligent or failed to use due diligence.

There have been efforts in Congress to overhaul TSCA and implement REACH-inspired legislation. While TSCA reform looms, EPA has initiated an enhanced chemicals management program, under which it has published aggressive “chemical action plans” for eight chemicals and plans to ban the use of mercury in a range of switches, relays, measuring devices and other products. These future actions could directly or indirectly affect semiconductor and circuit board manufacturers doing business in the U.S.

## **B. Emergency Planning and Community Right-to-Know Act**

The Emergency Planning and Community Right-to-Know Act (EPCRA) is a chemical reporting statute aimed at ensuring that state and local community emergency response agencies are informed of the nature and quantity of chemicals present in industrial facilities [4]. Most semiconductor and circuit board manufacturers are likely familiar and in compliance with the Toxic Chemical Release Inventory (TRI) reporting requirements found under EPCRA § 313 and the annual inventory reporting required under EPCRA

§§ 311 and 312, but there are a few legal subtleties that have presented pitfalls for the unwary.

Large quantities of reportable chemicals are often found in distribution centers and warehouses, exposing industrial operations to surprisingly high fines. For example, large industrial lead-acid batteries used in forklifts or found in certain emergency power backup systems can contain sufficient quantities of sulfuric acid to trigger EPCRA §§ 302, 311 and 312 reporting obligations. As an EPCRA “extremely hazardous substance,” if the aggregated amount of sulfuric acid from all batteries and other sources on site equals or exceeds 500 pounds, the sulfuric acid is reportable. In EPA’s view, even the lead in batteries is potentially reportable. Other examples of potentially reportable substances include processed metal stored on-site, large quantities of cleaning solutions, wastewater treatment chemicals, certain pesticides, refrigerants and inventories of laboratory chemicals.

To the extent a component manufacturer provides customers with maintenance or cleaning solutions for its products, these substances also could trigger the supplier notification requirements under EPCRA § 313. Generally, Section 313 requires manufacturers to notify customers if the chemical mixtures or trade name products they supply contain a toxic chemical listed under 40 C.F.R. § 372.65. If a product contains a listed toxic chemical, the supplier must then provide each end-user a written statement identifying the toxic chemical and its percent by weight in the mixture or product. EPA does exempt from reporting listed toxic chemicals that are present in mixtures in a “de minimis” concentration, unless the chemical is a persistent bioaccumulative toxic (PBT) chemical. For most toxic chemicals the de minimis concentration is less than 1%.

## **C. Importation of Ozone Depleting Substances**

Most companies importing electronic components or products containing printed circuits, transistors or similar components are potentially subject to a U.S. excise tax for

ozone depleting chemicals (ODCs) [5]. The ODC tax is imposed on imported products containing or manufactured with various chlorofluorocarbons, halons, carbon tetrachloride or methyl chloroform. For example, imported PCBs cleaned with ODC-based solvents during the manufacturing process to remove solder residue would be taxed. Where a company is claiming to use no ODCs or non-taxable ODCs, such as hydrochlorofluorocarbon-based solvents, the Internal Revenue Service requires a significant amount of substantiation, which is set out in its ODC Excise Tax Audit Techniques Guide [6]. The Guide provides that importers must obtain a letter from the foreign manufacturer addressing every component and subcomponent of the imported product.

“  
*For example, imported PCBs cleaned with ODC-based solvents during the manufacturing process to remove solder residue would be taxed.*  
”

#### **D. Consumer Product Safety Improvement Act of 2008**

Consumer product requirements have increasingly influenced the supply chain. A case in point is the Consumer Product Safety Improvement Act of 2008 (CPSIA), which imposed expansive new obligations. Under the CPSIA, manufacturers of any consumer product must demonstrate compliance with an applicable rule, ban, standard or regulation under laws administered by the CPSC through a General Certificate of Conformity (GCC). GCCs for adult products may be based on in-house testing (unless third-party testing is otherwise required in the underlying rule), but children's products are subject to testing by third-party accredited laboratories. Retailers and other downstream customers that hold a GCC produced in accordance with the CPSIA's requirements are exempted from liability for selling or distributing a product that does not conform with an applicable rule, ban, standard or regulation of the CPSC. Although there are a limited number of applicable requirements, this provision has led to a widespread demand

for GCCs, with obvious repercussion throughout the supply chain.

Critically, component testing has been viewed as a solution to the expensive costs of third-party certification requirements. Suppliers have been cautious, however, about providing blanket certifications in circumstances where a customer could alter the component. Further complicating the issue, the Consumer Product Safety Commission recently proposed

to require that any component or raw material supplier who elects to certify compliance of a component part (or raw material) must assume all responsibilities of a manufacturer with respect to that component part's compliance

with the applicable rule [7]. Thus, we would expect increasing tensions in the supply chain as suppliers who do not make or produce "consumer products" object to subjecting themselves to the jurisdiction of an agency which otherwise has no jurisdiction over their products and operations.

### **II. Distribution, Sale and Use**

#### **A. Mercury and Other Heavy Metal Restrictions**

Fourteen states have adopted legislation mandating the reduction and/or eventual phase-out of mercury when used in a broad scope of products and product components. These statutes generally require manufacturers to notify state agencies prior to selling mercury-added products and component parts and mandate product labeling. The Interstate Mercury Education and Reduction Clearinghouse facilitate implementation of these statutes and provide a publicly searchable database of mercury-added products and components.

Nineteen states have adopted legislation phasing-out the use and presence of mercury, lead, cadmium and hexavalent chromium in packaging. These toxics in packaging stat-



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utes are particularly relevant to new packaging technologies that rely on electronics as a means of data collection, security, or communication. Specifically, these laws: 1) prohibit the intentional addition of these four heavy metals in packaging and packaging components and 2) limit the sum of incidentally introduced lead, mercury, cadmium and hexavalent chromium to 100 ppm by weight [8]. Manufacturers and suppliers must also provide certificates of compliance to purchasers. The Toxics in Packaging Clearinghouse facilitates implementation of these statutes.

### **A. California Proposition 65**

The California Safe Drinking Water and Toxic Enforcement Act of 1986, better known as Proposition 65, in relevant part, prohibits any business from knowingly exposing any individual to any chemical known to the state to cause cancer or reproductive toxicity without first providing a “clear and reasonable warning” to such individual [9]. Clear and effective warnings must be provided against possible exposures from consumer products, the workplace and environmental exposures of listed chemicals above specified levels. It is the responsibility of the manufacturer (or for workplace exposures, the employer) to determine whether its products or activities can reasonably be expected to result in a significant exposure.

An exposure to a listed carcinogen is exempt from the Proposition 65 warning requirement if the responsible person can show that the exposure poses “no significant risk” assuming lifetime exposure at the level in question [10]. Exposures to listed reproductive toxins are exempt only if the person responsible can show the exposure will have no observable effect assuming exposure at one thousand times the level in question. For carcinogens, the no risk level is expressed as the “no significant risk

level” (NSRL) and for reproductive toxicants, it is expressed as the “maximum allowable dose level” (MADL).

Under California case law, the presence of a listed substance in a product creates a litigable issue of whether exposures to the substance will not exceed the relevant exposure criteria. This has prompted some companies to include a Proposition 65 warning statement whenever a listed substance is present, regardless of the NSRL. This approach is warranted to the extent a company is not prepared to demonstrate that the amount of exposure from using its products does not exceed the relevant criteria, as the litigation and publicity costs of a Proposition 65 action can be formidable. Proposition 65 warnings are often included in MSDSs, so they are familiar to many employers.

### **B. Green Chemistry Initiatives**

Several states have enacted green chemistry legislation aimed at reducing or eliminating

the use of toxic chemicals throughout a product’s life cycle and identifying safer alternatives. These state efforts are in different stages of development, with California’s program being the oldest and Maine’s program

the furthest along. In September 2010, California issued proposed regulations implementing its Green Chemistry Initiative, which would require manufacturers of consumer products containing a “chemical of concern” to assess whether a viable safer alternative is available [11]. Based on the expansive definition of “consumer product,” semiconductors and circuit boards used in consumer products are potentially covered [12].

### **III. End of Life**

Increasing public concern over the management of electronic and electrical equipment waste (e-waste) in the U.S. has resulted in a

“  
*Under California case law, the presence of a listed substance in a product creates a litigable issue of whether exposures to the substance will not exceed the relevant exposure criteria.*”



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rash of “extended producer responsibility” and “shared responsibility” approaches to e-waste minimization and reduction. There are currently no federal requirements directly on point. Some products may require management as hazardous waste under the Resource Conservation and Recovery Act if they contain heavy metals or other toxic constituents [13]. To encourage beneficial reuse or recycling, however, the U.S. EPA allows specified wastes that otherwise would qualify as hazardous, including “mercury-containing equipment,” to be regulated under a less stringent “Universal Waste” program [14].

U.S. states have taken the initiative in regulating e-waste. Over 20 states and New York City have enacted laws requiring the collection and recycling of electronic products. The legislation vary somewhat, but typically focus on computers, printers and “wide display devices.” As a general matter, the laws apply quite broadly to cover both consumer and industrial devices, provided they qualify as a “covered product.” Increasingly, the states are defining a “covered product” to be any that falls within one of the eight RoHS categories. Most states require the manufacturer to finance the collection and recycling of covered products [15].

#### **IV. Closing Thoughts**

The preceding discussion has provided a broad and cursory overview of U.S. requirements that may apply to, or affect, semiconductor and circuit board manufacturers and their supply chain. Although we expect the industry to focus on RoHS compliance in the coming months, it is important to remember the U.S. regulatory environment. Indeed, given the increasing patchwork of state regulations in the chemicals arena, the critical question may prove to be to what extent does compliance with the RoHS recast assure compliance with the increasing patchwork of U.S. requirements?

Special thanks to my colleague Adrienne Timmel for her assistance with this article.

These chemicals are long-chain perfluorinated chemicals, bisphenol A, short-chain

chlorinated paraffins, hexabromocyclododecane, phthalates and polybrominated diphenyl ethers. **SMT**

#### **References:**

1. 15 U.S.C. § 2601, et seq.
2. See TSCA § 5(a)(1)(B).
3. See 75 Fed. Reg. 49,656 (Aug. 13, 2010).
4. 42 U.S.C. §§ 11001-11050.
5. A product is subject to the ODC tax if it enters the U.S. for consumption, use, or warehousing and is listed in the Imported Products Table under Section 52.4682-3(f)(1) of the Internal Revenue Code.
6. See <http://www.irs.gov/businesses/small/article/0,,id=186588,00.html>.
7. See 75 Fed. Reg. 28,208 at 28,211 (May 20, 2010).
8. See generally, <http://www.toxicsinpackaging.org/>.
9. California Health and Safety Code § 25249.6.
10. California Health and Safety Code § 25249.10(c).
11. See generally, <http://www.dtsc.ca.gov/PollutionPrevention/GreenChemistryInitiative/Proposed-Regulation.cfm>.
12. The proposed regulations incorporate by reference the definition of “consumer product” under § 25251 of the Health and Safety Code, which is “a product or part of the product that is used, bought, or leased for use by a person for any purpose.”
13. See 42 U.S.C. § 6901, et seq.; 40 C.F.R. Part 262.
14. See 40 C.F.R. Part 273.
15. But see California, the only state requiring consumers to pay an advance recycling fee.






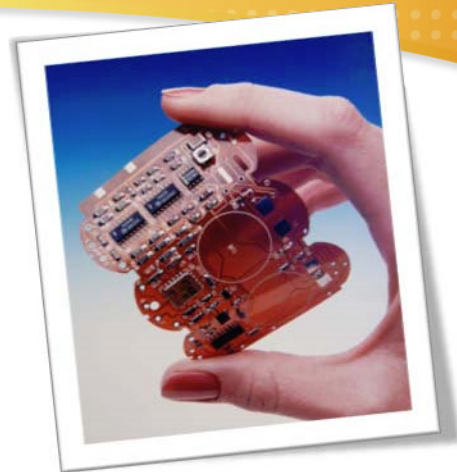
Jean-Cyril (JC) Walker, a partner with Keller and Heckman LLP, counsels both corporate and association clients on environmental and product regulatory issues. Contact him at 202/434-4181; [walker@khlaw.com](mailto:walker@khlaw.com).

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An abstract of no more than 300 words must be submitted by April 21, 2011, to [Susan Filz](#), IPC Director of Industry Programs. Presentations may be based on papers. Presentations should be non-commercial and emphasize new technologies, discuss trends

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For more information about the call for presentations, visit [www.ipc.org/reliability-cfp](http://www.ipc.org/reliability-cfp) or contact Susan Filz at +1 847 597-2884.

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# Transcript of Panel Discussion from DesignCon 2011



## REACTING TO THE AGE OF THE DOMAIN EXPERT: Industry Collaboration to Make Prototyping Easier Part 2

With David Doherty, Terry Heilman, Rick McClain, Vincent Accardi & Jeff Blauser  
Moderated by Bhavesh Mistry and Nolan Johnson

**Editor's Note:** This is a continuation of the DesignCon Panel discussion found in the March issue of SMT Magazine.

**BHAVESH MISTRY:** Thanks, Terry. This one is for Jeff, and as we start to move forward I think at a show like DesignCon it is appropriate that we take a look into the future a little bit. The trends in pain points that you and Vince, in particular, have kind of picked up on and discussed today, the more we talk to engineers the more that we're seeing their reality: That there are things that are going to limit our ability to be productive and to put out a prototype. In the future, however, do you see these problems continuing? Do you see new problems starting to pop up in engineer's design flows?

**JEFF BLAUSER:** Sure, this is not just for one panel and then all of us go our separate ways;

this is something that we see continuing on into the future. Faster, smaller, better, cheaper, whatever your ER word is, that's why we're all in the game here and I don't see that trend stopping or slowing down anytime soon. Now in a lot of cases we're faced with, perhaps on the computer side of the design, USB 3.0, PCIe3, SATA 6Gb per second, now we're talking about things in the gigahertz that are really tough to do design wise. There's a lot of ways this could get sideways in a hurry. To have first time success on something like that is very difficult, and as we continue our collaboration we have to make sure the models work, make sure that we have an understanding of the materials that the guys at Sunstone use to put together the PCBs, it's a dielectric now. That's an important part of your gigahertz circuit. How's that going to work? What does that look like? How's that going to happen? And we will continue this,

NXP is a silicon provider and we're doing multiple gigahertz on our devices in the digital realm now and that's only going to continue. When we send more designs into Screaming Circuits they're (the circuits) going to need to work. Well, after you get a few inches on a gigahertz kind of signal, a lot of that signal power is lost. How do we make sure that enough of it gets to where it needs to go? There's testing and things involved and that will wrap back around to some of the things that NI can do in the test arena. This will only get more and more important, Bhavesh, it's not going to slow down any time soon.

**DAVE DOHERTY:** Bhavesh, I would say this is clearly a journey and we're taking a first step. I'm excited to open up to questions because we want to hear from you if we captured hard pain points, but let's face it, as long as from an EDA tool environment you still have to take the time to draw out a schematic symbol or footprint and we can't auto download it to you, that's time you shouldn't be taking out of your life. If you download a functional block, a schematic, an IP block to help you accelerate the design, why can't you drop the IP block into your EDA tool and not build it up from discrete components? There's a whole bunch of challenges to keep us busy for some time and (smiling) we're just happy we have Terry's energy to keep us all together and focused because this won't be done at the end of this show or at the end of this year. Your needs will change and our requirements will need to evolve.

**BHAVESH MISTRY:** Great, thanks both Dave and Jeff for that. I guess kind of hitting on what you guys are talking about, we've mentioned a lot how this is in theory, this is about practice and getting the prototype done and working together to make it happen. Maybe I'll pick on Jeff for this one to begin with and maybe you can start chatting about some of the things that are in progress right now that are representative of this kind of collaboration. Perhaps you and Vince can chat about NI and NXP.

**JEFF BLAUSER:** A few months back, our two companies got together on the issue of models. We have somewhere in the order of more than 30,000 different ICs within the NXP portfolio. That's quite a large chunk of information to swallow. How do you do that? How do you take down the elephant? It's one bite at a time, and I think we've started down that process. It's important to us as silicon guys to make sure that our models get into the tools properly. So we have those discussions going on as far as making sure those models are accurate on our side and that we get those to you guys in a good way, in an accurate way and in a timely way. There's no use handing you guys parts we made back in 2002, even though we still have a few around; our shared customers need to see the ones we've brought out this year. We're trying to take steps to make that happen.

**VINCE ACCARDI:** And we're trying to absorb that data as soon as possible into our databases. We're trying to work with Digi-Key on making timely information on availability and pricing. Doing the basic things like being able to take a Gerber and know that when we send it off to Terry and Sunstone that the customer is going to end up with exactly what they expected and not something that is not going to be useful to them. That's the type of discussions we're having and information and technology sharing that we're having to make this a better process for you the customer, because it's about time that you're able to design a project that you deserve to design a project without the barriers that you have in place.



**BHAVESH MISTRY:** I think that leads nicely into maybe Dave and Rick talking about how you guys are ultimately responsible for getting that final board out and into the hands of the engineer. What kinds of things are you working on right now in order to make that happen?

**DAVE DOHERTY:** When I heard Rick comment and, ultimately, it does end with Rick, he's providing that finished board and the go/no go cognizant, we understand that boards get shut down for a couple of reasons. You could have technical mistakes with the timing, etc., but just as often it's an economic problem—I physically can't get the parts. They work, but you lead me down to a part that's got a long lead time or just went obsolete. I think the collaboration between Screaming Circuits and ourselves at that end part of the cycle is really about trying to make sure we've got devices that match your life cycle, your requirements for volume and the lead time you need to build your products after we've built in the right products from the beginning. If we get you that input during your device selection, you're making an informed decision to do that risk analysis. Stay on the leading edge, but not the bleeding edge, of the parts you select.

**RICK MCCLAIN:** I would say Screaming Circuits and Sunstone have been working a long time together, actually, and have really been giving you guys, the engineers, some choices in how you go about transacting for a prototype. Whether it's through the Sunstone Web site or through the Screaming Circuits Web site, you can go either way now and have one transaction versus two to speed up the delivery process as well. It's really about getting that information and reducing the amount of transactions that you guys have to deal with and getting you a board as quickly as possible.

**BHAVESH MISTRY:** Before I ask my last question I just want to mention that Nolan

will be running around and if you have any questions please just flag him down as I ask my last question to the panel and we'll have these guys up here for a while to chat. We currently see five companies up here: NXP, NI, Screaming Circuits, Digi-Key and Sunstone, and all five of you are up here talking about collaboration, about working together and about your various ongoing projects to make the engineer more successful. Is this collaboration that you're building a closed community? Or open to anyone else in the EDA industry?

**RICK MCCLAIN:** I wouldn't say it's closed; I think "moderated" is probably a better term.



Again, we're really about how do we work better together as these separate companies to make the information flow easier. How we work together is not really all that controlled. Sometimes we work individually as companies and sometimes we work all together as

companies. The focus, again, is the design engineer and how we go about better servicing you.

**VINCE ACCARDI:** None of what we're doing is proprietary. We're trying to be as open as possible with this. Dr. Truchard commonly describes that what NI tries to do is to make tools for engineers that do the same things as the Excel spreadsheet did for accountants. Ultimately, that's not just our goal, but I think it's largely our entire collaboration group's goal. What we're trying to do is trying to provide tools that significantly improve and facilitate your life, overcome the barriers between the use of those tools and allow for the entry into the process or exit out of the process at any point of your chain. You're not locked into a specific chain—we're trying to facilitate it for you and we hope we find a great solution for you, but it is by no means proprietary. It's completely open and we all work with other companies, not just those you see up here.

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**BHAVESH MISTRY:** Terry, do you have anything to add there?

**TERRY HEILMAN:** I think just a couple other comments that it's not just about numbers. We have five up here right now, but I think it very likely that if we were up here a year from now that there would be different people, additional companies and so on. Because this needs to grow, that's for sure, but as Rick says, we need to not control it as such, but we don't want to jump too quickly. We want to make sure we get the right things set up to begin with and that's what we have now. It will definitely be growing and as we see through media as well as, more importantly, the specific results of design engineers, there's definitely a need to do exactly what we're doing. I think as you get more and more folks involved that you're going to see more and more people that really walk the talk a little more of this collaboration.

**BHAVESH MISTRY:** Thanks very much guys. Nolan, do we have any questions out there?

**QUESTION:** As mentioned before, speeds are going up very much in the gigahertz region. I was wondering if it's possible to get the models that are S-parameter models? Not just SPICE models, because SPICE is a no mesh analysis and these are dealing with multi-gigahertz speeds, you're dealing with distributed systems and S-Parameters would be a much better choice.

**VINCE ACCARDI:** I know that NXP, for example, does provide S-parameter models. We have the capability of generating S-parameter models from our circuits. There is a barrier for SPICE and it's in the 500 kilohertz to megahertz range. Anything above that, and even in that range, you need specialized component definitions, but anything above that it tends to not work as well. And what we're looking at just as a company ourselves is to look at other partners that can help us go

beyond those barriers. It is a different type of design as you go up in speeds and we're taking that into account.

**JEFF BLAUSER:** I think sometimes we hold our own mirrors very close to our face and we don't see a lot of things. What's been a very good experience for me, personally, representing NXP is sometimes we hear from the member panels what we can do differently, certainly better, and part of that is an outcome. You mentioned are S-parameters available and Vincent says yes, and that's something I would say that we as silicon guys have just brought online. I won't say it's completely across the board, but yes, you should be able to find many S-parameters from us. If you can't find a particular one, you can always put in a tech support request and we can get those to you now. So we've heard that, and thank you for asking those kinds of questions.

**QUESTION:** My question is more on the general attitudes towards collaborations: Why is there a theoretical acceptance that more collaboration leads to more innovation? But then there's a practical aspect of it which is IP production. Then there are certain stages of product development where a little more



collaboration externally is helpful. There's a little more collaboration internally which is just needed at a later stage when you're actually working out the technical details. My question is: What is the paradigm that you see getting easily adopted? Like, for example, early stage product development, more open collaboration, less oversight versus late stage collaboration, late stage development or more restricted collaboration. Why there might be a need to collaborate more and share more data at the later stages. Do you practically see that happening in the industry in the near future?

**JEFF BLAUSER:** I think that's a great, insightful question and I would suggest to you that with the collaboration that you see

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here what we offer to you is getting to the point of you bringing your idea of whatever that IP that you have that's specific about your design, clearing out the rest of the other stuff that you have to worry about and being able to concentrate just on that. So you're not using a lot of your own time tracking down tracking and ordering parts, drawing your own schematic capture signal or coming up with your own model or things like that. It allows you to concentrate on your IP, so it clears away and makes that a whole lot easier.

Certainly it cuts down on the time element of that so you can concentrate on your thing. Then when it comes to our individual IP, it lets you come to us individually if we need to do that separately. Again, it allows you more time to approach the provider, whether it's any of us or someone else, and be able to talk and understand, ask questions and get to the bottom of what it is you need to know. Whether it's early collaboration, or you've implemented what you need to do and then within this ecosystem bring it back to that source of the IP that you're using and say, "This is my implementation. Did I do it right? Or do you see any other problems with how I did it?" It gets you to that point faster. Everything's important, but the less urgent things can be taken care of more easily.

**VINCE ACCARDI:** I'm going to add one more thing to that. Something that's proprietary is the accumulation of all your information and there are ways to break up your projects so that you can maintain something that's proprietary to you without revealing the entirety of it. The one thing that you can be assured of is that any one of these companies you're working with will maintain the confidentiality with you and your specific project. We're not taking your data and sharing it amongst other places. What we are offering, though, is a higher level of expertise in areas that you might not have it to help you enhance your proprietary information. I think

that we would add value, not detract from that proposition.

**QUESTION:** Do you see a kind of attitude shift happening as a newer generation of workers dominates the task force? This is a generation that's relatively more open to sharing their lives on Facebook and everything, so confidentiality takes on a whole different meaning for them. Do you see a trend happening where as executives, those of this generation, are more open to taking on that risk of putting their information out there with their suppliers who might have outsourced our offshore manufacturing or design centers? They take on that risk with the potential reward of getting better designs or getting faster innovation achieved in the process.



**DAVE DOHERTY:** I have a couple of thoughts. I think we've learned as a country to compete in a global environment and initially I think the mindset was protectionism. We're going to make sure to, and we absolutely should, protect our IP. But, at the end of the day, the only thing that's really defensible is our innovation and the speed of execution. If companies want to, reverse engineering will happen in places around the world and will continue to happen. And I think you're absolutely right, you go to the forums today and you see the engineering inputs. If you've got a question and you place it in the right community people will be very open—sharing their logic, sharing their firmware, telling you how they solve problems—and it will be that innovation that carries us through the day. We've learned to adopt.

For me, coming from a direct sales environment to Digi-Key, we don't try to push information; we don't call out. We try to create a reservoir that you can come and pull up when you need it. I think that is what's happening, because you don't want to be bombarded because we can't anticipate what products and what parts you need. You know



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that. You go to a search engine or you can use a tool, you should be able to grab these pieces on demand any time of day, whatever platform you're on. If you're not open and you put barriers up for that, it just won't work.

**TERRY HEILMAN:** I think the other thing is that if people wanted to stay afterwards and talk to a couple of the folks up here in the panel, I think you would find each one of them to say that even though they've shared quite a few things it's been much better for them as a company, themselves, forgetting about even the collaboration of this whole group. But individually, it's been much better and there's more creative things, innovative things, efficiencies and so on. So absolutely, it's very positive and I think you're right, the old days of locking things up, not that there aren't some proprietary things, but that really is not what we're looking at going forward. It's just not necessary.

**RICK MCCLAIN:** I think one of the other things that this generation is starting to see is that they want choices; they don't want to be dictated to. I think that's some of the things that we're trying to talk about, as well. Do you have a choice where you want to enter into the process and where do you want to exit? Or you can use the whole process. I think choice is a very important thing for this generation coming in.

**TERRY HEILMAN:** Design engineers should



be going on strike. They should go on a revolt. They absolutely need all this stuff and it's our job to provide it to them and we're going to do it. It's simple.

**BHAVESH MISTRY:** Thanks guys. Just a quick one for the panel, if there's anybody out there that wants to learn about the way in which these five companies are collaborating is there somewhere that someone can go to learn more on this, what we call in circuit design, ecosystem?

**TERRY HEILMAN:** Sure, I would say probably the first thing would be just to get onto [www.circuitdesignecosystem.com](http://www.circuitdesignecosystem.com) and if for some reason that doesn't work then e-mail to [njohnson@sunstone.com](mailto:njohnson@sunstone.com) and, if he can't answer it, I'll get a new Nolan Johnson (laughs all around).

**NOLAN JOHNSON:** Don't worry, I'll answer.

**BHAVESH MISTRY:** All right guys, thanks very much. If we could get a round of applause for the full panel, they flew in from all over the country to be here today.

I would like to thank both the panel, as well as our audience, today. Just very quickly, as we close up, I just think one of the biggest things I learned from the panel and that I'll take from here was that there are some significant pain points in the lives of engineers today. And, ultimately, it's realizing that there are common customers between each one of these companies and that it's the onus of the companies to make it easier to transition from one to the other—whether it be from NXP to Digi-Key, from Sunstone to Screaming Circuits, from National Instruments to Sunstone. Ultimately, it's on the EDA company and the EDA industry itself to make the customer's life easier and more successful. I think there are still definitely some interesting things here that ultimately can help make that game more productive. But, I'd again like to thank everyone and have a great DesignCon. **SMT**

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# ERP SOFTWARE: How It Enables Businesses to “Lean,” “Green” and Prosper in the “New Normal” Economy

by **Harold Katz**  
SYSPRO USA

## IN SUMMARY

Harold Katz explains how both “lean” and “green” are achievable via the judicious selection and implementation of an Enterprise Resource Planning (ERP) software solution. Due to the savings that ERP software can produce, such software is also essential to prospering in the coming “new normal” economy.

During the early years of the last decade, the adoption of “green” practices was a major concern for manufacturers and distributors. While government legislation did much to promote “green” initiatives, the overall consensus was that the responsibility to conserve the earth’s resources and save the environment rested with the business community. However, the recession of the past three years has seemingly put “green” on the back burner. Companies appear to have abandoned their green goals, concentrating

instead on ways to survive the severe economic downturn and remain viable in the emerging “new normal” economy. The shift has been to “lean” rather than “green.” However, the two are not only compatible, they are “sides of the same coin.”

I’ll explain how both “lean” and “green” are achievable via the judicious selection and implementation of an Enterprise Resource Planning (ERP) software solution. Due to the savings that ERP software can produce, such software is also essential to prospering in the coming “new normal” economy.

Why is the “new normal” economy a concern? The severity of the current recession has dramatically brought one point to the forefront: The old spending patterns were never sustainable. They were based on an economy of cash-out refinancing in a world where the value of property only went up. To gain additional funds, owners had only to re-finance to draw equity out of their homes. Similarly, manufacturing and distributing entities facing rising energy, labor and material costs had only to boost prices to maintain their profit margins. The simple fact is that in the “new normal” people and businesses are going to have to live within their means.



**Why is the “new normal” economy a concern? The severity of the current recession has dramatically brought one point to the forefront: The old spending patterns were never sustainable.**



In the “new normal” economy, with a growth rate approximated at 2% or less, several certainties will follow. Business cannot be conducted in the same manner as before. The market today is highlighted by a new kind of consumer demand where cash is king, discounts are standard and consumers have an expectation of higher value at lower cost. This means that in the world of manufacturing, downward price pressures will continue, stabilizing at lower price points than in pre-recession years. Manufacturers may realize smaller profit margins, and economies of scale will not be as prevalent as they were in past years. Companies will be looking to technology to survive and prosper.

In the “new normal” economy, manufacturers and distributors will have to adopt “lean” environments where the focus shifts from individual supply chain elements to a holistic approach that emphasizes throughput of the entire supply chain. Companies will need a strategic intelligence that permeates enterprise-wide tactical and operational decision-making. Decisions will need to be based on what is best for the company, as well as for the customer. Technology will be a necessity.

According to AMR Research, “We are now seeing midmarket firms take the next step looking for additional cost savings and process efficiencies from business system improvements.” Results of a recent AMR survey also reveal that “cost reductions and efficiencies continue to rule the day as the primary driver...”

How can manufacturers and distributors “live within their means?” The first step is implementation of an ERP software solution that coordinates all resources, information and activities needed to execute business processes and measure performance. Real-time enterprise software provides an operational business infrastructure in which an organization can formulate a strategic vision, establish operational guidelines throughout the supply chain and provide the necessary real-time data to promote the most efficient and effective decision-making. This is the very foundation of the lean/green

manufacturing concept and a key requirement of the “new normal” economy. ERP software, encompassing sophisticated Forecasting and Inventory Optimization tools, must be the foundation upon which manufacturers in the “new normal” economy can lean and green operations, shorten cycle times, enhance customer service levels and produce profits.

The biggest expenses manufacturing entities face today center on labor and inventories. The “just-in-time, make-to-order” concept so prevalent in American industry only a few years back has given way to a more costly make-to-stock model, where the value-add of labor results in significantly higher costs of maintaining inventories. This is what hurt the automobile industry. The American manufacturer must now face the challenge of “doing more with less.” Now’s not the time to capitalize assets, but to capitalize on them. ERP solutions can aid manufacturers in returning to a more cost-effective, lean and green make-to-order manufacturing strategy, as opposed to maintaining large, costly inventories of finished product. By presenting “real-time” snapshots of business conditions, ERP software enables management to make the timelier critical decisions that promote revenues and profits.

The following functionalities are available through many ERP software solutions and help facilitate “lean” and “green” through energy savings, the re-use of resources, the reduction of waste, electronic data management, sophisticated forecasting, inventory optimization and numerous others means:

- Real-time alerts can be used to send replenishment information, internally or externally. Replenishment rules against each item can be used to initiate actions to further just-in-time processes.
- Document Flow Manager (DFM) and Electronic Data Interchange (EDI) functions can be used to automatically process electronic documents and communications. Transactions can be sent and received digitally.
- Sophisticated ERP solutions can easily

integrate disparate systems and create custom solutions to generate interoperability and streamline processes.

- Web facing modules facilitate direct communications and visibility and provide transactional capability with trading partners.

- Forecasting functions facilitate demand-driven manufacturing by generating realistic forecasts using a variety of sophisticated algorithms. Some systems can automatically determine the best algorithm for each item based on historical usage.

- Some ERP systems feature Inventory Optimization and Warehouse and Quality Management functionalities which work together to take control over inventory spend and stock levels and uses the intelligent software to squeeze out unnecessary costs to better manage cash flow and service levels. They enable companies to eliminate all unnecessary expenses, including those associated with the production and storage of inventories. Inventory optimization reduces inventory obsolescence, identifies and manages excess stock to improve cash flow, decreases inventory holding costs and increases inventory turns to improve profitability.

- ERP shortens lead times associated with warehouse transfers, supplier orders and order shipments to customers.

- Customer Relationship Management (CRM) within an ERP provides a 360-degree view of each customer relationship. CRM builds and maintains a powerful library of customer information, including credit limits, shipping addresses, order history and much more. In turn, these records help companies to speed up ordering and delivery cycles.

- Facilitate transfers between warehouses by issuing a Supply Chain Transfer, a type of sales order which enables internal transfers to be reviewed and receipted in the same manner as external purchase orders. When the stock in one warehouse is inadequate to satisfy demand, the system suggests inter-warehouse supply chain transfers as an alternative to new purchases.

- Return Merchandise Authorization (RMA) provides a highly efficient method of

controlling the return or exchange of items sold to customers, ensuring the visibility and tracking of the item returned until the transaction is concluded. Instant on-screen access gives complete RMA information. Because the system maintains an unlimited history of RMAs, it also helps a company to identify recurring problems.

ERP software solutions enable SME manufacturers and distributors to enhance operational efficiencies with new architecture and modules, feature sets, workflow and customization capabilities. ERP enables mid-market manufacturers and distributors to gain all the benefits of a leading-edge software program even though they may possess limited resources and skills.

ERP solutions can match software development with industry trends and customer needs, including “green and lean orientation.” The ideal ERP software company will seek customer inputs at every level to ensure that ERP software enhancements maximize customers’ competitive advantages in their respective markets.

This is the time for American manufacturers to learn from past mistakes, return to basics and leverage available technology to establish a foundation for future profitable growth, albeit a growth that economists predict will be less than robust.

By making the right business technology decisions now, manufacturers will be able to better compete, take advantage of market swings, lean and green their operations, promote sustainability and prosper in the “new normal” economy and beyond. **SMT**



Harold Katz is the Technology Enabling Manager for SYSPRO USA, spearheading the company’s general management and business strategies, as well as developing the technology enabling leveraging strategy and assisting with the enhancement of executive goals and objectives.

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# TOP TEN

SMTonline  
News

## Most-Read News Highlights from SMTonline this Month

### ① **The Debate: Will Plated Copper Vias Replace Solder?**

Electronic solder has served the electronics hardware manufacturing industry, in many forms, for nearly 100 years—since the birth of the industry. Our debaters, Joe Fjelstad and Dr. Hayao Nakahara, will discuss the risks and potential rewards of a game-changing manufacturing shift.

### ② **IPC APEX Expo Aims to Further Understand Green Electronics**

According to IPC's Director of Environmental Policy, Fern Abrams, the issue isn't that the industry does not support green initiatives, but rather that some of these initiatives give the appearance of helping the environment when they ultimately do not.

### ③ **Avnet Expands Offering with Endicott Interconnect Portfolio**

As the latest addition to the Avnet Electronics Marketing Americas line card, EI provides a powerful combination of CoreEZ organic substrates and high-performance HyperBGA semiconductor packages to Avnet Electronics Marketing customers throughout the Americas.

### ④ **Book Review: How Reliable is Your Product?**

After reading Mike Silverman's new book, you come away with a feeling that anything he doesn't know about reliability is not worth knowing. This handbook offers a complete overview of all facets of product reliability, including developing the right metrics for your products, developing your own reliability plan, and having the most effective corrective action system.



## 5 Report: China EMS Factory Working Conditions Improve

More profound changes and overall improvements are unlikely to take place until workers become informed and aware of their rights and are given full and unrestricted rights to organize and express themselves.

## 6 Jabil Buys Back Divested European Operations

Jabil Circuit, Inc. announced today that it has acquired three of its former operations in France and Italy, which were divested in July of 2010.

## 7 Sparton Inks ID/IQ Engineering Subcontract

The five-year subcontract is for technical efforts related to continued sonobuoy development, improved performance and advanced capabilities.

## 8 Henkel's Thermal Solutions for Any Application

When it comes to addressing the thermal management demands of today's advanced electronics devices, there is no "one size fits all" solution. Effective thermal management, especially at the TIM2 level, is more critical than ever, as devices continue to shrink in footprint and increase in functionality and, therefore, keep getting hotter.

## 9 Neways Reports Profit Recovery in 2010

Neways Electronics International N.V. managed to turn a loss in 2009 into a net profit of € 5.1 million in 2010. Turnover was up 35% to € 254.5 million.

## 10 Benchmark Expands Capabilities in Malaysia

Benchmark Electronics, Inc. today announced that it has acquired facilities and certain other assets to expand its precision technologies capabilities in Penang, Malaysia.



# I'll Take Super Computers for \$2,000, Alex

by Barry Matties  
I-CONNECT007

If you are fan of *Jeopardy!* you know they have once again changed the world, and it is nothing short of amazing. Technologists at the IBM research center have built a replica of the *Jeopardy!* television game show's studio. The key difference at this studio is the super computer, named Watson, attached to it. Here, in this game show research center, the IBM team worked on Watson in preparation for a nationally televised match between Watson and two *Jeopardy!* champions.

So what's so special about Watson? Aside from the fact that it can play a game show based on random answers, it does so by processing natural language (the core of all mankind is stored in natural language). During the *Jeopardy!* event Watson amazingly came up with the right questions, a very high percentage of the time, instantly. And when it got it wrong, it let us know its confidence was low. In addition to that, it is constantly learning, consuming new information and making it meaningful, in real-time. The computer never forgets. Every bit of information is accessible at lightning speed.

So what does this mean to us? The team at IBM has looked at this very question and came up with life changing answers. One area they talk about is the impact that Watson will have in the medical field. Imagine going to see a doctor for some illusive problem. When your symptoms are analyzed by Watson your doctor will have instant access to all pertinent information on what ails you. This, of course,



Photo courtesy Jeopardy Productions, Inc. and IBM.

## IN SUMMARY

The answer is: IBM has changed the world, again, with this new super computer. What is Watson? That is correct! *Jeopardy!* has changed the world as we know it—and it's nothing short of amazing.

leads to a very speedy and accurate diagnosis because Watson can sift through a sea of natural language information—your doctor now has a tool unlike any other. For a doctor to review and consider all of the published information it

could take a lifetime; and if you're the patient, a lifetime may not be so long.

The team came up with other examples of how Watson will change the world. The first step, however, was to compete on *Jeopardy!* After just four short years in development, Watson came to the game ready to win. And win it did, handily. As you watch the match you will see Watson was not perfect; in fact, he came up with the incorrect answer several times. The team at IBM isn't claiming perfection, but they do realize Watson is a huge breakthrough as the world's most advanced computer and it will only improve.

Watson could change the world economics. Imagine having a tool that could accurately predict what companies might be acquired... and do this on a daily basis. It could also analyze the stock markets by looking at all influences, worldwide, that will affect the markets. This analysis tool now gives your difficult questions meaningful answers from a vast amount of information at an incredible speed. It can do in minutes what would take a team of market researchers months or years to do. And when they think they're done, the information has changed so they need to start over.

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*Activity: Manufacture of Printed Circuits*

*Geographic Area: France*

*Current Workforce: 379 Employees*

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*2010 Sales: (projected) 42.3 Million Euros*

*Final Date for Submission of Bids: May 16, 2011*

Access to the presentation file will be allowed after regularization of a confidentiality agreement, with a brief presentation of the candidate for recovery.

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*Note: Records of recovery will be provided only after written presentation of candidate buyer.*

provide all kinds of insightful answers on market trends, consumption rates, to every opinion published about a product. It's not that Watson can just extract the information like Google; it's that it can provide you answers to your specific questions. This level of access is a game changer. You might think product life cycles are short now, but I predict that the time frame will be reduced to an unbelievable shorter cycle. Imagine trying to compete against a company that is utilizing the computing power Watson offers. You might stand a chance, but it will be a very slim chance.

Watson will assist with production work flows, supply lines and product distribution. It could analyze all of the variables that might impact your business, such as weather in Asia that may interrupt a critical shipment, to a localized union strike that is brewing in some other region. It could examine raw material costs so you can make adjustments before it impacts your business. It can analyze the smallest detail that can affect your company's competitive advantage.

Business is built on a lot of decisions based on whatever information we have at hand. Watson enables you to look at every bit of information, some that you may have never even considered simply because you did not have the resources to do so. In the end, having information is only part of it, finding the right answer within the data is the critical part and that is where Watson excels.

From product design to customer service, Watson has a place. I can't imagine the military not latching on to this technology. The days of talking to a computer like Captain Kirk has done so many times before in each mission are here. When Kirk spoke in natural language, the computer responded with meaningful, strategic answers to help the starship Enterprise survive the most intense battles, or avoid them altogether.

In our wars, such as the difficult one against terrorists, Watson will be a powerful tool. It could be used to analyze purchases of potential bomb making materials to the activities of an individual through all means; by tracking license plates recorded in street cams, information in newspapers, banking records, school enrollments and all other public and not so public information. The key is the speed in

which Watson can sift through all of the data, natural language included, throw out what is not useful and key in on what is and, again, do this at lightning speed.

When it comes to crime fighting, I expect a version of Watson will be in the offices of the CIA, FBI and every major police department. It's a new crime fighting tool unlike any other.

I don't want to oversell Watson, but I think we have just had a major breakthrough in computing technology. Some still say that a computer can't replace the power of the human brain. I agree. However, the human brain has to study a lifetime to attain a thin slice of knowledge typically limited to one or two areas of expertise. How many years does it take to become a great doctor or financial expert? Watson isn't here to replace that dedication; it is simply a tool for us to access all of the meaningful information humans generate to assist us in answering our important questions. By doing so, it will change the way we think and live our lives.

To learn more about Watson, visit [www.ibmwatson.com](http://www.ibmwatson.com).

By the way, Watson is not perfect. The computer recently lost a round of *Jeopardy!* to Rep. Rush Holt (D-NJ). Holt, a nuclear physicist, competed against Watson in a special congressional edition of *Jeopardy!* and won the round \$8,600 to Watson's \$6,200. **SMT**



Barry Matties started in PCB manufacturing in the early 80s. In 1987, he co-founded *CircuiTree Magazine*. Nearly 13 years later, *CircuiTree* was sold as the leading publication in the industry. In the early 2000s

Barry and his former *CircuiTree* partner, Ray Rasmussen, joined forces again and acquired PCB007. Over the years, PCB007 has grown and continues to thrive. In July of this year, Barry and Ray acquired *SMT Magazine*. With his many years of business leadership skills, Barry now produces this column for anyone who has a desire for success. The column relates 25 years of successful business leadership, including marketing and selling strategies that really work. Read a few and decide for yourself.

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## TENDER FOR RECOVERY IN THE CONTEXT OF BANKRUPTCY PROCEDURE

(Articles L. 642-22 the French Commercial Code)

Group leader in the field of printed circuits composed of  
10 companies, research candidate buyer or financial partner.

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