

Greetings Colleagues,

## When the Lights Go Out: LED Failure Modes and Mechanisms

Light Emitting Diodes (LEDs) are the wonder component of electronic devices. Blinking indicators and light sources make the black boxes of our profession capable of communicating with their users. Have yours "gone out"? It's easy to forget that these optical devices are fundamentally electrical, and failure analysis tends to follow the same rules as other silicon-based components. [Click here](#) for an insightful article on the function and construction of LEDs, common failure mechanisms, and basic fixes appropriate to each type of failure.

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## Why is HALT not HALT?

One of the sweeping change propagating through the electronics industry has been the widespread adoption of highly accelerated life testing (HALT) as part of the design verification and product qualification process. One problem: HALT is not accelerated life testing. [Click here](#) to learn why.

## An American RoHS...

Concerns over a confusing patchwork of state regulations, with California in the lead, has driven Newark in One to [call for national legislation](#). And it seems Congress will [respond](#).

## ...is already here

Of course, their arguments may be irrelevant, because the Federal Government is already recommending RoHS compliance. Surprised? The [Electronic Product Environmental Assessment Tool](#) (EPEAT), already in use by [multiple government agencies](#) (DoD, DHS, NASA, DoE), recommends that computers be purchased/selected based on their [compliance with the RoHS legislation](#). Can anyone say 'tipping point'?

## Who Doesn't Want Pb-Free (Part II)?

The military isn't too fond of Pb-free either. At least the tin plating kind. Specification documents being developed by the Defense Logistics Agency, Defense Supply Center Columbus will state that the use of pure tin is prohibited. Specifically, "Tin content used in materials shall not exceed 97 percent and an alloy material shall be chosen to inhibit the growth of tin whiskers." The nitty-gritty on this? It is not the 97% that is important; it is the 3% lead (Pb) that stops whiskers. And Pb is actually effective down to 1%. The higher number gives you the margin that DoD and NASA demand.

## Caution on SACX

Continued disappointment in the performance of tin-silver-copper (SAC) solder, especially in regard to manufacturability and mechanical shock performance, has resulted in the proliferation of Pb-free alloys with 'special' ingredients. This [article](#) on 'crack-resistant' SAC is a classic example. Without property characterization over the range of expected environments and reliability models backed by time to failure data, companies requiring high reliability should tread warily.

## THE list of RoHS Exemptions

Two excellent documents on RoHS exemptions have recently been released. John Lau, formerly of Agilent Technologies, has put together an excellent [article](#) describing all the exemptions to RoHS and their current status. In addition, if you want an in-depth understanding behind the justification for acceptance, and rejection, of exemptions to RoHS, we would highly encourage you to read this [report](#) by the Oko-Institut and the Fraunhofer Institute for Reliability and Microintegration.

## Is the High-Rel Ship Sailing?

Electronics manufacturing in America is making a comeback, thanks primarily to the efforts of the very high-rel industry (medical, military, avionics). However, there are already indications that this may not last forever. High margins in this area, 25-30% vs. 10-15% in other areas, are driving global EMS providers to be more aggressive in acquiring market share. Numerous EMS providers have already opened plants in lower-cost countries that are certified to ISO 13485 (medical quality management standard) and registered with the FDA (e.g., [Solecton-Suzhou](#); Flextronics-Singapore; [brokers](#)). Avionics is going the same route, with global EMS providers ([Celestica-Johor Bahru, Malaysia](#)), Tier 2 US suppliers ([Sparton-Vietnam](#)), and smaller regional EMS providers ([CAE-](#)

[Wuxhi, China](#)) trumpeting avionics certification and quality (AS9100). And military electronics? PCBs are already [there](#), with a wink and a nod to ITAR (under ITAR § 126.1, Chinese and Vietnamese manufacturers are not allowed to fill orders for ITAR-controlled PCB's, but Taiwanese seem to be exempt). Will PCBAs be next? Stay tuned.

## DFR NEWS

### **DfR Solutions Announces Partnership with Israel-based BQR Reliability Engineering.**

DfR is pleased to announce that the company has joined forces with BQR Reliability Engineering, an Israel-based company that provides software tools and consulting services for reliability, availability, maintenance and safety (RAMS) and Integrated Logistic Support (ILS). As part of the agreement, DfR will act as a United States distribution channel partner for BQR's software, BQR will represent DfR's products in Israel, and both companies will share software architecture to develop reliability solutions.

According to Dr. Craig Hillman, "The synergy of BQR's and DfR's products and services make this an ideal alliance. Both companies have unique expertise in design for reliability. We look forward to jointly expanding each other's market, and to collaborating on DfR's upcoming reliability software, 'Sherlock,' which will be introduced in late 2007." To read the full press release [click here](#). For BQR brochure [click here](#).

[Click here](#) to read Dr. Craig Hillman's thoughts on industry trends for 2007.

## UPCOMING EVENTS

### **Commercialization of Military and Space Electronics (Los Angeles, CA: March 12)**

[Craig Hillman](#) will present two half-day seminars focused on "Selecting a Lead Free Solution for Military, Avionic and Space Applications." This talk will provide critical data and information on developments over the past 6 to 12 months in Pb-free technology, including market trends, process solutions, and quality and long-term reliability issues.

Recent GEIA documents, which are expected to be the backbone of lead free product qualification for military and avionic applications, will be reviewed in regards risk minimization activities. For more information, please contact [Leon Hamiter](#) or [Sheena Mitchell](#).

### **Best Practices of Failure Analysis (Milpitas, CA: March 27-28)**

[Jim McLeish](#) will present a two-day seminar focused on "Best Practices of Failure Analysis." This seminar will provide reliability engineers and management a foundation by providing a comprehensive review of the best practices in engineering and reliability assurance with case studies that will provide guidance on the practices most appropriate for a given design, use environment, desired lifetime, and available resources. For more information, please contact [Tina Silk](#) or [Sheena Mitchell](#).

[Craig Hillman](#) and Jim McLeish will be visiting the Bay Area the week of March 26 to speak to a number of companies on a variety of topics (Pb-free, supplier assurance, reliability prediction, etc.). If you are interested in having Dr. Hillman or Mr. McLeish speak at your company or sit down with your staff to discuss your latest quality and reliability issues, please contact [Sheena Mitchell](#) to make arrangements

### **MIT/Industry Consortium on Advanced Automotive Electrical/Electronic Components & Systems (Seattle, WA: April 12-13)**

[Jim McLeish](#) will present an hour-long seminar regarding the importance of utilizing a Physics of Failure (PoF)/Reliability Physics strategy in automobile technology and design. Attendees will learn how PoF can be used with hybrid, voltage control, and other new automotive electronic technologies to ensure ultimate product integrity. For more information regarding the presentation, please contact Jim McLeish. For more information regarding the event, contact [Gary DesGroseilliers](#).

**SMTA International Conference for Soldering & Reliability (Toronto, ON, Canada: April 17-19)**

Craig Hillman will be presenting a full-day seminar, "Reality of Pb-Free Reliability". Attendees will receive a clear and comprehensive presentation on the latest information regarding Pb-Free reliability, including tin whiskering, pad cratering, selecting a Pb-free solderability plating, copper dissolution, and long-term reliability under thermal cycling, vibration, and mechanical shock. Especially informative will be an extensive review of relevant case studies. For more information, contact [Sheena Mitchell](#) or [Melissa Serres](#).

**SMTA Medical Electronics Symposium (Bloomington, MN: May 1-3)**

Craig Hillman will present a workshop entitled "Failure & Root Cause Analysis in Medical Electronics." Attendees will learn about failure mechanisms unique to medical electronics, and the tools and techniques used to identify these mechanisms. This workshop will be part of a half-day seminar in collaboration with Mike Silverman of Ops Ala Carte. For more information contact [Sheena Mitchell](#) or [Melissa Serres](#).

**Military, Aerospace, Space & Homeland Security (MASH): Packaging Issues and Applications (Baltimore, MD: May 7-10)**

[Gerd Fischer](#) will present a tutorial on lead free reliability issues and solutions. For more information on the presentation contact Gerd Fischer. For more information regarding the event contact [Tom Green](#).