

**White Paper**  
**The Reliability Cycle: Understanding the  
Booms and Busts of Reliability in  
Electronics**

## The Cycle of Reliability

### The Past

Those who interact closely with DfR realize that we proscribe to the theory of the 'reliability cycle'. The early years of electronics, 1950's and 1960's, were disasters for reliability and led to the establishment of the organizations and tools currently used today (IRPS, MEOST, RAMS, FMEA, etc.). Establishment of large electronic OEMs such as Motorola, Texas Instruments, and IBM in 1970's and early 1980's resulted in extensive reliability practices and organizations that are still awe-inspiring, even today.

The breakup of these organizations and the dominance of cheap consumer electronics in the early 1980's through the mid 1990's brought on electronics that would fail if you breathed on it too hard. Realizing that some degree of reliability was required and faced with the great uncertainties of environmental legislation, international OEMs brought new tools and new resources that rivaled the activities of their peers 25 years ago, but without the excessive costs that killed market share (think planned obsolescence: it just needs to be reliable enough). Certain electronic OEMs quadrupled their reliability staffs in a matter of few years.

### The Current

However, the buzz in the air, even with record attendance at the Reliability and Maintainability Symposium (RAMS 2008), is we are about to hit another bust. At least in North America. Discussions with numerous OEMs indicate that reliability staffs are being slashed as concerns about a recession grow and the need to cut overhead costs increases.

In addition, the fundamental shift in the focus of Western companies is continuing. Manufacturing has been outsourced for years. Design is going down a similar path. In fact, the newest, sexiest companies in Western countries often have little to nothing to do with manufacturing and, lately, even design. As companies staffed with sales, marketing, finance and legal personnel have little understanding of the value of reliability staff, this has resulted in reliability activities being pushed farther into a supply chain that is increasingly being necked down.

The degree that thousands of component manufacturers and electronic OEMs rely on a select number of suppliers is staggering.

- Suppliers to component manufacturers
  - Two companies (TSMC and UMC) own over 50% of the die foundry market<sup>1</sup>
  - Five companies own 90% of the market for epoxy resin molding compounds, with one (Sumitomo Bakelite) capturing 35%<sup>2</sup>
  - Three companies (ASE, Amkor, and SPIL) own almost 40% of the semiconductor packaging market<sup>3</sup>
  - JFE Mineral owns an estimated 60% global market share for nickel powder used in metal electrodes in BME MLCCs<sup>4</sup>
- Suppliers to OEMs
  - Three companies own over 65% (Murata, TDK and Taiyo Yuden) of the multilayer ceramic capacitor market<sup>5</sup>
  - One company has almost 40% of the resistor market (Yageo)<sup>6</sup>
  - Two companies (Foxconn and Flextronics) have almost 45% of the EMS market<sup>7</sup>

OEMs, to a lesser extent, suffer from the same problem.

- Five companies share 52% of the computer market<sup>8</sup>
- Five companies share 58% of the television market<sup>9</sup>
- Five companies share 81% of the cell phone market<sup>10</sup>
- Five companies share 88% of the server market<sup>11</sup>

These kind of choke points in the supply chain are almost too many to count. Of course, the real question is what does this all mean? Well, it means a lot of things.

<sup>1</sup> <http://www.eetimes.eu/germany/201803796>, SMIC passes Chartered in foundry rankings, Mark LaPedus, EE Times, 09/03/2007 4:15 PM

<sup>2</sup> [http://www.sumitomo.gr.jp/english/discoveries/special/89\\_02.html](http://www.sumitomo.gr.jp/english/discoveries/special/89_02.html). It is a snapshot of the page as it appeared on Aug 31, 2008

<sup>3</sup> <http://www.gartner.com/it/page.jsp?id=620907>, Gartner Says Worldwide Semiconductor Assembly and Test Services Revenue Increased 7.4 Percent in 2007, STAMFORD, Conn., March 12, 2008

<sup>4</sup> [http://www.ttiinc.com/object/me\\_zogbi\\_20070305.html](http://www.ttiinc.com/object/me_zogbi_20070305.html), Will MLCC Prices be Going up in April 2007?, Dennis Zogbi, March 05, 2007

<sup>5</sup> <http://www.electronics.ca/reports/components/chips.html>, Chip Passive Components Industry Report, 2007, Research Report # RIC9156, Publication Date: November 2007, Research in China, Number of Pages: 81

<sup>6</sup> <http://www.taipeitimes.com/News/biz/archives/2007/10/30/2003385493>, Taipei Times, Yageo marks 10 years in China, By Jessie Ho, Tuesday, Oct 30, 2007, Page 12

<sup>7</sup> <http://www.evertiq.com/news/read.do?news=7780&cat=1>, Chart: EMS Top 7 after the FLEX/SLR Deal, Evertiq, June 07 2007

<sup>8</sup> <http://arstechnica.com/news.ars/post/20080417-apple-dell-big-market-share-winners-for-the-first-quarter.html>

<sup>9</sup> [http://www.tvweek.com/news/2008/05/worldwide\\_tv\\_sales\\_almost\\_flat.php](http://www.tvweek.com/news/2008/05/worldwide_tv_sales_almost_flat.php)

<sup>10</sup> <http://www.gartner.com/it/page.jsp?id=747414>

<sup>11</sup> <http://www.gartner.com/it/page.jsp?id=745516>

One, nobody is keeping their eye on the 'entire' ball. The cry of 'application-specific', which means 'don't blame me', is rising through out the supply chain. Interactions between materials and materials and process or effects of non-standard environments are not being captured until the product is at the customer. And with more OEMs moving to a 'trust, but not verify' your supply chain, the fox is guarding a big hen house. A VERY BIG HEN HOUSE.

Two, it means that there are no longer numerous gates to capture potential issues. A decision by Sumitomo to use red phosphorus was never fully vetted in part because relatively few organizations are assessing the change before they reach the consumer marketplace. Combine this with OEMs increasingly outsourcing reliability activities to their supply chain and the future is clear.

## **The Future**

One can not begrudge OEMs for outsourcing reliability activities. As they perform fewer design and manufacturing activities, they become like their customers, the service providers. Wal-Mart, Verizon, and United Airlines perform relatively few, if any, reliability assessments on products that go into the equipment that serve them and their customers (servers, routers, controls, etc.). They expect a certain degree of due diligence from the OEMs. And now, the OEMs are passing along that due diligence to their supply chain.

However, service providers do not completely let their suppliers off the hook. What partially, and I do mean partially, takes the place of reliability assessments are industry standard certifications. GR-63 Core, DO-160 are just some of the standards performed by neutral, independent parties that service providers rely on. OEMs, if they continue their outsourcing ways, will have to rely on a similar set of 'reliability' standards to assess their supply chain.

As with most trends, some OEMs will have to suffer painfully before they realize handing over all reliability activities to the companies building or designing their product without any verification was going to lead to a 'bust'. At that point in the future, the market place will be in search of independent reliability certifications. For those neutral parties, like DfR Solutions, able to bridge the gap between OEM and CEM/ODM and provide a clear, concise, and comprehensive reliability assessment, demand can be expected to be strong. And, maybe, we will experience yet another reliability 'boom'.

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