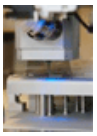

Announcements/Exclusive Articles

Index

Exclusive

February 11, 2010

Why the Future of Reliability in Electronic Products Matters

Joseph Fjelstad, President, Verdant Electronics

One of the hallmarks of electronics manufacturing over the course of its history has been its relentless pursuit of making each new generation of products ever smaller while simultaneously increasing their performance.

The reliability of those products was for many years, unquestioned and was the cornerstone of the industry's success. However, over the last decade or so, the electronics industry has been slowly sliding off its once sturdy foundation as evidence builds that newer generations of products are proving less reliable than the ones that preceded them.

For those readers not old enough to remember it, there once was a time when electronic products were designed and expected to last for as long as 20 to 25 years and hopefully more. It is more than a little bit evident that consumer choice and expectations have undergone some significant changes in recent times.

Where in the past, a product was designed for function and reliability, emphasis has shifted more towards trendiness and fashion relative to electronic products with myriad features that often go unused. Unfortunately, those are treated in the same cavalier manner as clothing fashions, good for this season but not the next.

The electronics industry has even adopted terminology which reflects this with terms like "application specific reliability" now part of the electronics industry lexicon.

The roots of this disturbing trend actually run deep back in time, more than 75 years to the Great Depression. The concept of planned obsolescence was the forerunner of what we see in operation today.

It can be dated to 1932 by the publication of Bernard London's pamphlet titled *"Ending the Depression through Planned Obsolescence"*. The basic idea was to create a product that became obsolete or ceased to function after a certain period of time or amount of use in a way that is planned or designed by the manufacturer.

Provided the producer did not alienate his customer, planned obsolescence offered clear benefits for the manufacturer because when the product failed, the consumer needed to purchase a replacement, which would presumably then be a newer model or perhaps a competitive product.

The "ad men" of Madison Avenue did their part by helping to design new and alluring products and fuel consumer desire by blurring the line in the consumer's mind between their wants and needs. That simple principle should not be underestimated for it is the engine that drives the engine of economics and economic growth.

This activity was not inherently bad given the situation but for planned obsolescence to do its job, a self-destructive element is often enlisted (implicitly if not explicitly) to help out. Its name is poor reliability. It appears that it did not go unrecognized by everyone however.

In "Brave New World" written by Aldus Huxley in the 1930s Huxley described a world of the future where hypnopaedic messaging was employed to control and direct the actions of the populace, using broadcast messages such as "Ending is better than mending" and "Less stitches means more riches". Anyone watching today's broadcast television might well hear echoes of those words in today's advertising.

Today electronic product development cycles run from 12 to 18 months compared to 24

to 36 months in the not too distant past. This is also not innately negative except for the unstated fact that product life expectations have been lowered, again implicitly if not explicitly, to match product cycles. "So what?" one might ask. The answer is that it is simply not sustainable.

Moreover, knowing now with a greater degree of certainty than ever before what we now do about global warming and its causes, it should seem to a reasoning person to be utter folly.

(Note: This comment is made acknowledging fully the recent "email-gate" controversy and the recent spate of cold weather the northern hemisphere has been experiencing and also reminding the reader that climatologists routinely try to drive home their often unheard message that there is a great deal of difference between weather and climate.)

Thus it seems that we are morally obliged to seek to find ways, not to shut down manufacturing but ways to make it more efficient and effective. One way to do this is to make more reliable products. If products are made to last, we need not remake them so often.

Looking at case in point, a recent report titled *"1 in 3 Laptops fail over 3 years"* and published by electronics warranty provider Square Trade shined a light the electronics industry's slipping reputation.

The paper noted that a full two-thirds of these failures (20.4%) were the result of hardware malfunctions and other third (10.6%) were from accidental damage (which was likely due to dropping in many cases, which in turn is known to cause solder joint failures, especially with lead-free).

The report also notes that the increasingly popular netbooks are projected to have a 20% higher failure rate from hardware malfunctions than more expensive laptop computers. This is, or should be, a shocking wake up call to everyone, manufacturers and consumers alike.

Unfortunately, one of the likely contributors appears to be lead-free solder, a well meaning but misguided bit of legislation from the EU. Reliability experts tried to warn of the risk of potential failures but the warnings were not acted on.

To date, the global electronics industry has spent several tens of billions of dollars to make the conversion and now both the consumer and the environment will be paying an ongoing price for the folly of this energy wasteful and less reliable assembly technology.

Moreover, early failures result in higher warranty costs to the manufacturer and the potential for product recalls, the cost of which can run into tens of millions of dollars and that number could be multiplied many times over as every manufacturer faces the same risk.

Lead-free is not the lone culprit, however. Dr. Craig Hillman of DfR Solutions, Inc. has pointed out that the semiconductor industry, which is driven largely by Moore's Law continues to pursue new ever finer feature nodes, seemingly oblivious to the impact of such on long term reliability.

The problem is that each new generation of integrated circuit technology, which must adhere to the laws of physics, is proving less reliable over time than the past. In a presentation at a Coventry, England SMART Group sponsored "Technology World" conference in November 2008, Dr. Hillman presented a graph which showed long term reliability of ICs has been in rapid decline since feature sizes dropped below 250nm.

The implications are that industry is now on the cusp of producing products that might have mean life times of less than 5 years, when only a few short years ago, lifetime expectations ran to several decades and even as long as a century or more.

Shifting thoughts slightly, there are four billion people at the bottom of the global economic pyramid and they cannot afford to buy a new electronic product with the same frequency as those at the top. These people could make good use of the products with which we have become bored.

If we are to hold to the precepts of sustainable manufacturing, shouldn't we make products that are be robust enough that they can be passed along to future generations for use, if it is at all possible?

In Japan, the manufacturing community has rallied around the idea that there is need to build products tied to the goals the "Three Rs"… reduce, (materials and energy), reuse and recycle.

These are worthy objectives, however, one might conclude that these three Rs, writ small, can be easily taken in and addressed a single, bigger R, writ large, encompasses all of the three smaller Rs. That big R stands for reliability.

One potential solution to the present challenge is to turn one area of the technological clock backwards just a few years and while continuing to press the edge of technology in the area of 3D. This latter area is presently underway with TSV (through silicon via) and stacked chip solutions which achieve the objectives of extending Moore's Law by going vertical.

The 3D approach has the potential to do extend the reach of the spirit of Moore's Law without suffering the potential loss of reliability due to leakage caused by diffusion of metals through silicon at lower nanometer nodes.

There is another thing to consider. IC designers are presently putting more and more function into chips which is too often untapped by the next level circuit designer. This creates a great deal of waste in terms of both money and energy. This gives rise to a simple question: "What if the product level circuit designer could design using only the exact IP circuit blocks he needed and nothing more?"

This is not a terribly radical idea; it is the way things used to be in early circuit design. The older readers will remember Heathkit electronics which provided such simple building block components which the hobbyist could use to create their own electronic products and systems. T

hese early designs were crisp designs, designs which were comprised of nothing more than was needed and in keeping with the advice of Albert Einstein who stated that "one should make things as simple as possible and not one bit simpler".

Carrying the thought forward a bit further, the reader is asked to consider the possibility that all of the components produced containing those IP blocks were produced and packaged on a wafer, each of them having their I/O on a universally used common I/O pitch.

The IP block chips produced in such a manner would also be both small and cheap (and importantly, there are now emerging developments in component handling technology that will make possible the assembly of devices as small as 100µm on a side.

The designer could then layout his or her circuit in much less space with fewer layers yet with much greater ease as routing channels would be predictably and easily navigated, in a manner described by Professor Len Shaper and his colleagues at the University of Arkansas in their IMPS design concept.

The final product might well look something like (or even very much like) LEGO® blocks. All of the supporting technology could follow a similar path making equally simple products that fit the basic pattern. This would include connectors, sockets, test systems and the like.

This provides a path to the future that is clear and easily understood and interestingly it takes its lessons from the past when most companies designed and manufactured PCBs using a fundamental grid pitch 100 mils (0.100"centers) because most components lead pitches were as well. It was then and still is, at its core, both simple and powerful.

Moreover it could well pave the way to much easier and improved system design and a less expensive alternative to system on a chip and system in a package.

As a final thought looking forward with these concepts from the past, while solder technology can easily be adapted to the concepts described, given the problems of lead-free solder, the concepts are perhaps better suited to a manufacturing concept called the Occam Process, which sidesteps the soldering process altogether.

This technology is in development in several locations around the globe and promises to obviate all of the myriad concerns that attend the soldering process including the growing concern about lead-free solder joint reliability.

In summary, the tailings removed from the intellectual mine in which the electronics industry has been digging for the last several decades is a high value ore, rich in opportunities and capable of providing significant and sustainable value to the electronics industry and its customers, both now and in the future.

The simplicity of many past concepts which have been discarded should be reevaluated in the presence of new and evolving technologies which can extract the value that has been left behind.

The resulting products should prove both cost and energy conservative and not only more reliable but equally important, more sustainable and environmentally responsible to help address the needs of the four billion people at the bottom of the pyramid.

Joe Fjelstad, President
Verdant Electronics

Comments

Letter to the Editor

Do you have a comment to offer? Use the form below.

Letter Title

Your Name

Your Company

Your Email

Comment

Hyperlink

If your letter refers to an article we ran, please include the hyperlink to the original article above.

Authentication ~~22236~~

Please type the number above into the box.

If you attempt to submit information and receive an error, you may need to refresh the page and insert the information again.

If you continue to have a problem with this form, send an email to info@circuitnet.com

Submit Reset