

A Rationale and Road Map for Standardization of Logic Element Manufacturer Data Presentation

MAPLD 2001, September 11-13

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Purpose of this Paper

Plant a seed of thought that could grow into a better means of communicating the good, the bad and the ugly about active electronic elements such as Programmable Logic Devices. (PLD's)

All engineers recognize that there are no perfect parts. They Just need a quicker, more easily understood view of the “Warts” of the parts.

Even excellent parts have idiosyncrasies which when understood can be over come by good design practices. However, they must first be communicated by other users and most importantly by the manufacturers.

Marketing Pressures are Different for Parts People than for Car People

Car buyers are amateurs who don't understand automotive engineering. If they understood that their new car wasn't perfect, they wouldn't buy it.

Electronics engineers are sophisticated folks. They understand that all parts have glitches and they like being creative in finding risk reduction solutions around the glitches.

But, first, they need to know the glitches are there.

Industry doesn't need to fear the engineer.

It's time for Truth in Advertising

The “warts” that the parts have may not exist in the manufacturer literature.

If the “warts” are documented, it is most often buried deep and in small print and usually has spin language in the explanation.

WIRE, (The Wide Field Infrared Explorer), A Case History

The WIRE instrument was a solid hydrogen cooled IR telescope part of the NASA SMEX series missions.

The aperture cover came off prematurely due to a poorly documented “Wart” in a PLD.

The suddenly sun loaded telescope vented high velocity hydrogen gas that caused uncontrolled spacecraft spinning, and loss of the mission due to completely exhausted hydrogen in hours instead of months.

Failure Reviews by NASA and SDL EM testing Revealed the Problem

A critical PLD in the pyrotechnic control box powered up with outputs in an indeterminate, (usually asserted) state.

The device also had a memory of one to two hours such that the indeterminate state anomaly was unrepeatably for that period of time.

When the device came up on orbit it asserted its outputs which caused an over-ride of the inhibits such that door pyro's fired during the first orbit rather than 5 days later after full spacecraft attitude stabilization.

Added Insight into the Part by GSFC and SDL and the Manufacturer

The device had an onboard DC to DC converter which disconnects all the device programming circuits from the logic cells. During this time the device is undefined and the outputs asserted.

The condition lasts about 14 milliseconds, long enough for the WIRE pyro fire relay to activation time of about 10 milliseconds to get a fire pulse to the pyro's.

How Can This Have Happened??

The question is how did this get by testing? The answer is simple.

The SDL testing was done using a power supply rather than a battery. Bad decision. “Test like it will fly” is the law now at SDL.

The use of the power supply which took 150 milliseconds to come up to operation masked the 14 millisecond indeterminate state of the device.

In addition, the device had a capacitive induced charge acting as a virtual state memory for upwards of two hours. Even when using a battery, the phenomenon could not be reproduced soon after the first power up.

Did the Manufacturer Know About This?

If one dug deeply enough into the manufacturer literature, one could find rather obscure references to such a phenomenon.

This was a major idiosyncrasy of the part, but hard to dig out.

It was certainly a phenomenon that every designer would need to be aware of and should have had an up front and clear reference in the literature.

Apparently, the manufacturer felt the problem was not an issue with mainstream customers and would be an “unnecessary” negative about the part

So What Do Engineers Really Need To Know for Risk Mitigation About These Parts?

MORE!!

A better and standardized data sheet with particular focus on the following would be helpful:

1. Detailed radiation effects upon switching thresholds, power consumption and input leakage.
2. Total dose and upset phenomenon including other user test results if the manufacturer has not done the tests.
3. Noise immunity and noise generated by the device as measured from it's power supply.

So What Do Engineers Really Need To Know for Risk Mitigation About These Parts?

4. Better power estimation guidelines from the manufacturer, perhaps using an industry standard circuit model.
5. Power up phenomenon-most parts have these issues regardless of vendor. This is very important for parts in critical applications such as the WIRE door pyro controller.
6. A list of systems where the parts have a use history, good or bad.
7. Many others too lengthy a list for this paper.

So, What Should Motivate A Vendor To Clearly Reveal the “WARTS” on Their Parts??

Vendors who will take a proactive role in voluntarily going to a higher standard of truth in advertising will become preferred vendors in the hearts of the users.

Of course, if the “Princess/Prince should be too ugly, then even revealing the warts may not sell the part. (This is most often not the case.)

We never ever want a repeat of the WIRE problem....again....ever!

Where Do We Go From Here As A Vendor/User Community?

Develop a user/vendor guidance council to standardize a truth in advertising data presentation format for all vendors.

This council will have a charter to:

- A. Develop a standardized data sheet with adequate focus on the parts “warts”.
- B. Develop an advocacy within high level management in Government and commercial “at risk” entities.
- C. Assure that the council is long lived and effective.
- D. Become a central source of information and links to useful information on the WWW.
- E. Do whatever it takes to get the vendors on board and using the truth in advertising standard app notes or data sheets

And Just Where Do We Go From Here To Get The Magic Started?

Draw a group of supportive and interested parties from the typical MAPLD attendee pool as an interim council.

Utilize the MAPLD conference as an opportunity to hold one of two yearly meetings with most of the work being done via the internet/e-mail

GSFC/SDL can provide interim council chairmanship for the first year. The first meeting to be held at SDL (central to both coasts), in November 2001.

A second meeting with real results to be held at MAPLD 2002.

The Summary Pay-off

The taxpayer/consumer will be better served.

The engineers will work more efficiently if they have to dig less deep for the information and will breath easier and will be much happier customers.St

Honest vendors will have more cooperation from engineers even when things get ugly.

Everyone can be a winner