Williams Consulting ® Reliability Engineering Services

Reliability Newsletter

We are your biologically safe way to have your Reliability work done!

Derating Electronic Components

I get a lot of questions about Derating and Stress analysis related to predictions as well as stand alone.

Here is my two cents worth.

Derating is a design process that can make a significant contribution to reliability. This article briefly describes policies and methods for derating electronic components. Derating is a policy of deliberately under stressing components in order to provide increased reliability. The selection of components of higher stress capability than is required for normal operation is an effective and established method of reducing their failure rate.

Stress rating is the ratio of applied stress to rated stress. Example, the ratio of applied voltage to rated voltage in a capacitor. Generally, as stress increases failure rate also increases, usually exponentially. Typically, the components to which derating is applied include transistors, resistors, transformers, integrated circuits, micro-electronic devices, and other passive electronic devices with stress dependent failure rates, such as capacitors and inductors.

If you have any questions or comments please feel free to contact me.

Issued in 1864, the 2-Cent Piece has the distinction of being the first coin to bear the inscription "In God We Trust."

PAUL WILLIAMS, CRE

(303)775-6120

Paul@williamsconsulting.org

WWW.WILLIAMSCONSULTING.ORG

Paul@mtbfreport.com

WWW.MTBFREPORT.COM

Derating Electronic Components

History shows a number of equipment failures are due to inadequate design margins. Failures caused by stress transients in the operational environment are in fact often due to inadequate design margins. Test conditions seldom reproduce these transients, and failures of this kind are, therefore, difficult to diagnose in the field. Derating can eliminate many such potential problems.

Electronic components are subject to at least two stresses, an electrical stress, with increasing tendency to breakdown due to voltage, current or power and a thermal stress due to the thermal environment and its own power dissipation. The method described here are aimed at reducing failures by increasing design margins, i.e. the margin of design strength over expected stress. To make the biggest impact on the overall system failure rate a derating policy must be applied to as many components as possible. The significant stress to be derated is particular to each generic part type and its failure mechanism. In the case of semi-conductors, it is generally the power that is derated to control the junction temperature. In capacitors it is the voltage stress for a given temperature on the dielectric that is critical.

Software applications attempt to automate derating analysis with varying levels of success. The limitations an “Automated” derating tool is typically the maintenance of the tool by engineers who understand the derating methodology and are well versed in the components being analyzed. Proper categorization of the components to ensure the correct derating factors apply are a key but often problematic area of derating projects. To get the maximum benefit from derating analysis, perform it early in the design process so that resulting changes can be easily implemented. Have the analysis performed by a professional with sufficient experience to recognize a trivial result from an important one. The tools used to do this analysis are less important than the experience and expertise applied to the task.

PAUL WILLIAMS, CRE

(303)775-6120

Paul@williamsconsulting.org

WWW.WILLIAMSCONSULTING.ORG

Paul@mtbfreport.com

WWW.MTBFREPORT.COM