As seen in:
Electronics Sourcing Europe May/June 2013
Electronics Sourcing North America July/August 2013

DESIGNING SEMICONDUCTOR CIRCUITS FOR TROUBLE FREE PERFORMANCE

Jack Radgowski, Founder & CEO Central Semiconductor Corp

Every product has a customer and a potential customer, and every customer has several potential suppliers anxious for the business. It makes little difference how good you think your product is, if the customer isn't delighted, or at least somewhat satisfied with your design, the chances are he/she might not be back. If you think your customer wouldn't consider alternate sources, think again.

There may be several reasons why your circuit will not be used or continue to be used, but very basically, it's probably because the customer's needs, usually some combination of performance, quality, reliability, price, and service are not being satisfied. Fulfilling these requirements will go a long way towards satisfaction, thus maximizing the chances of repeat business. Your part meeting these requirements enhances your customer's product and increases the chances of continued success. In short, your goal should be to do everything you can to help make your customer's product positively stand out over his/her competitor's.

Of all the things needed to keep your customer happy, the most important of all is trouble free operation throughout the life of the product. Nothing will turn off your customer more than a field problem, and nothing will hurt your company more than a failure that is attributable to your product.

You need to make certain that your product is designed and manufactured using components of reputable Quality and Reliability and not of questionable origin. It doesn't pay to skimp here. One failed component, resulting in just one field failure can permanently damage your company's reputation, resulting in a lost customer and business. Again, your goal should be to do all within your power to enhance your customers' products.

Of all the components that make up an electronic circuit, perhaps the most critical and susceptible to misdesign or misuse are the semiconductors. Not surprisingly, of all the customer complaints our company receives, over 90% are as a result of component misuse, where one or more of the maximum values have been violated. Semiconductors behave well and perform amazing functions but only when used in accordance with their respective design ratings. Based on our experience, the three most critical semiconductor design considerations for the prevention of overstressed semiconductors are the prevention of the possibility of voltage or current spikes and overheating of the junction (Tj). Spikes can be caused by feedback from external sources or by undesirable interaction among circuit components. Central Semiconductor goes a long way towards fulfilling its customers' needs with manufactured product of unquestionable quality and reliability.

Central Semiconductor Corp., in the business of manufacturing quality discrete semiconductors for over 35 years, strives for its components to meet strict Reliability level standards of single PPM values. Numbers of this level can only be achieved as a result of millions of unit-hours of ongoing accelerated life testing, on substantial samples of production lots of product of the same family, with minimum failure.

The manufacture of Central's semiconductor components begins with wafers of high quality, designed and perfected over time and produced to withstand even the slightest minute changes of electrical characteristics when subjected to: package assembly, subsequent High Temperature Stabilization Baking, and use in the field by the customer over the useful life of the end product.

The semiconductor specification lists typical electrical characteristics as well as limits and maximum ratings. The circuit designer must make certain that the semiconductor component's maximum ratings of voltage, current, and temperature are not exceeded. Punch-thru and junction melting can be caused by excessive voltage or current spikes, either of which may be caused by faulty interaction of associated circuit components or by extraneous means. Excessive heating of the junction temperature, (Tj) is usually caused by improper consideration and application of the specified thermal resistance value.

Volumes have been written about Thermal Resistance, and the importance and applications thereof, but very basically, proper component heat sinking and ambient temperature control go a long way to keeping the associated junction temperature problems to a minimum. In a nutshell, the thermal path between the semiconductor junction and the ambient must be sufficiently conductive to insure that the maximum junction temperature is not exceeded. The maximum value specified for Thermal Resistance is a test lab value, and at best, is only a guide for the circuit designer. It is a value specified by the semiconductor manufacturer, under specific mounting conditions, which may or may not be the same as the customer's. It is also a value that may be used for comparing different manufacturers' devices, but the comparison would be valid only if the mounting conditions of material and dimensions are identical.

Summarizing, in successfully designing circuits with semiconductors, consider the device ratings of voltage, current, power, and temperature, using all with a reasonable margin of safety, as well as consideration for the possibility of faulty interaction from other components, and extraneous factors.
Be certain that the semiconductors are procured from a known reliable manufacturer or reputable franchised distributor, thereby limiting the risk of receiving counterfeit or otherwise poor quality components from unreliable or questionable origin.

www.centralsemi.com