

## Environmental Reliability

### Introduction

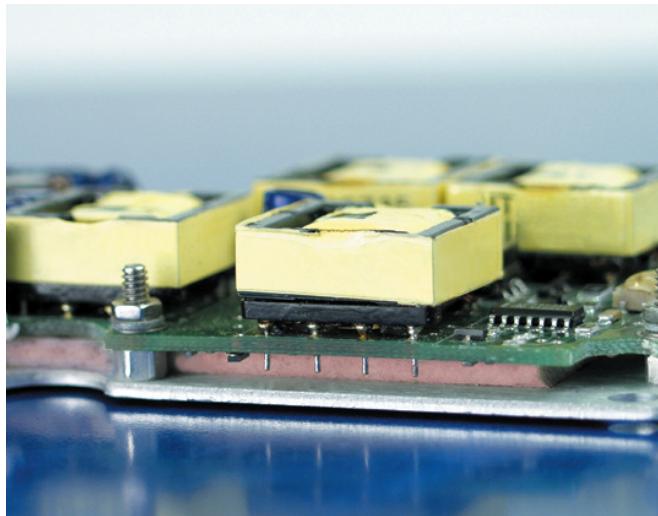
This report outlines Bergquist Laboratory results of the environmental reliability testing conducted on GAP PAD® VO Ultra Soft.

GAP PAD® VO Ultra Soft is a highly conformable, thermally conductive gap pad material that is ideal for low stress assemblies and applications. Expect consistent and reliable thermal performance with GAP PAD® VO Ultra Soft, even when exposed to extreme environments.

The Bergquist Laboratory tests Thermal Interface Materials (TIMs) in the following environments: 85°C/85% Relative Humidity, Continuous Bake and Thermal Cycling. The 85°C/85% Relative Humidity environments can quickly degrade test materials that react with water and/or have a tendency to oxidize.

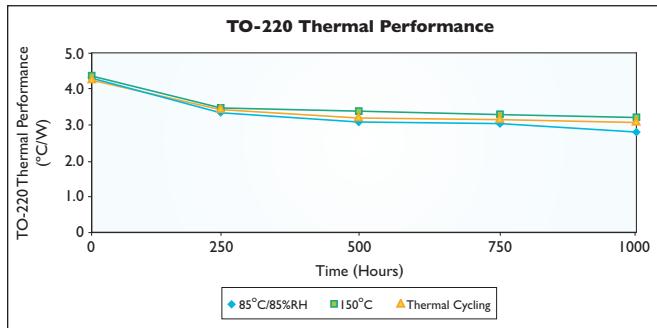
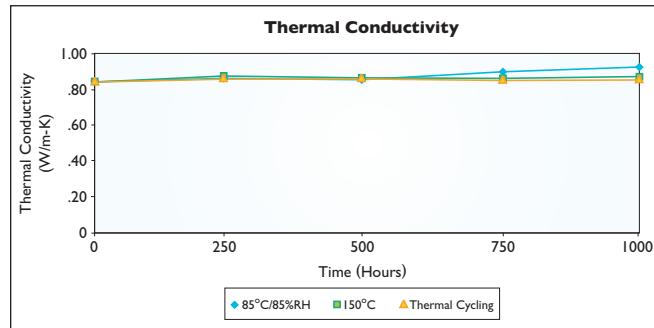
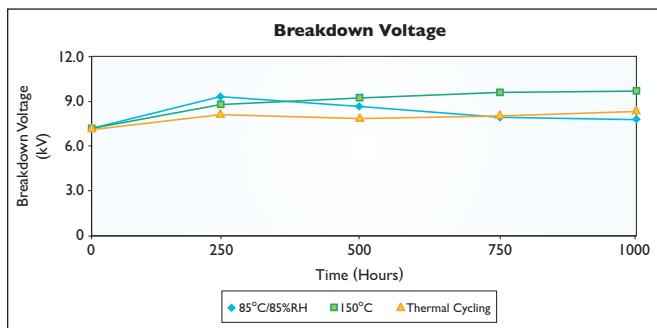
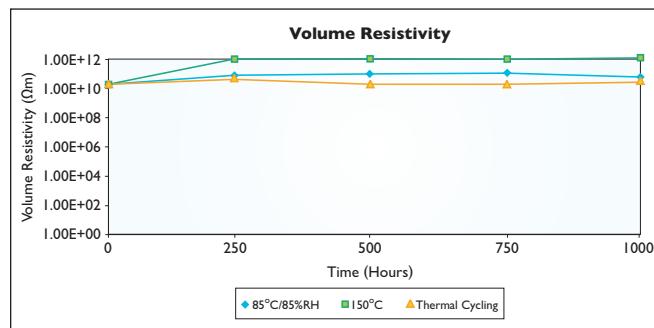
The High Temperature Continuous Bake environment accelerates changes in material characteristics for TIMs with temperature sensitivity. The TO-220 Thermal Test Vehicle utilizes copper and aluminum components. In the Thermal Cycling environment the CTE mismatch of metals creates a great deal of stress, in turn inducing significant internal and external stress upon the test material, potentially resulting in a reduction in performance.

The goal of the environmental reliability testing is to accelerate aging of the TIM and determine the effect on the key material characteristics, thermal performance and voltage breakdown while in a controlled laboratory setting. The TO-220 Thermal Performance Test utilizes the thermal test vehicle shown in the Figure 1 inset. GAP PAD® VO Ultra Soft is subjected to constant pressure throughout the test via spring clip. At regular intervals the thermal test vehicle is removed from the oven chamber and powered on. Thermocouples are utilized to measure the transistor junction, transistor base, heat sink and ambient temperatures. Thermal Performance is reported as the temperature delta between the transistor junction and the heat sink divided by the power dissipated by the TO-220. GAP PAD® VO Ultra Soft was exposed to 85°C/85% Relative Humidity, Continuous Bake (150°C) and Thermal Cycling tests (-50°C to 150°C) for 1,000 hours.



Thermal Test Oven Chambers

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**Graph 1: TO-220 Thermal Performance Testing**

**Graph 2: Thermal Conductivity Testing**

**Graph 3: Breakdown Voltage Testing**

**Graph 4: Volume Resistivity Testing**


Note: All graphs are based on 20 mil thickness

### Conclusion

GAP PAD® VO Ultra Soft consistently provided thermal performance, thermal conductivity, voltage breakdown and volume resistivity throughout the duration of the Bergquist laboratory environmental reliability testing and no significant degradation were observed.