

# GREEN PRODUCT ROADMAP

## Our Philosophy

*KEMET will conduct its business in a manner designed to protect the health and safety of our employees, our customers, the public, and the environment.*

**KEMET Corporation's Environmental Policy**



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# KEMET and the Environment

Our concern for health, safety, and the environment is paramount. We are constantly seeking ways to eliminate or reduce the use of hazardous materials and our ultimate goal is to completely eliminate waste. To that end, our intent is to eliminate the use of hazardous materials, including reformulation of our products to “design out” hazardous materials. Our goal is to meet all legislative mandates within or ahead of our customer base’s expectations.

## RoHS and ELV Compliance

All KEMET **surface mount capacitors** are available in RoHS and ELV compliant versions<sup>1</sup>. Through-hole devices are quickly catching up. A RoHS / ELV compliant version of both our **Golden Max** conformally coated radial ceramic and **Aximax** conformally coated products were released in 2004<sup>2</sup>. Other RoHS / ELV compliant leaded products are scheduled for release in early 2005. For status by specific product line, refer to the **“Legislative Compliance”** section.

<sup>1</sup>COG and low CV (<10nF) X7R ceramics are RoHS compliant with exemptions.

<sup>2</sup>C350s not available with lead-free terminations until March, 2005.

# Lead-free Termination Status

All KEMET **surface mount capacitors** are available with lead-free solderable terminations. Lead was eliminated from our ceramic surface mount plating process over a decade ago. Billions of these parts have been successfully used in both historic tin lead and higher temp lead-free soldering processes. KEMET has also offered a lead-free terminated version of tantalum and polymer surface mounts for over a decade. In March 2004, KEMET announced transition of the standard termination for these products to lead-free. The transition schedule by series and case size is provided in the “**Tantalum Lead-Free Conversion Schedule**”. KEMET aluminum and high-temp polymer (T525 series) capacitors were introduced with lead-free terminations.

KEMET introduced **Golden Max** conformally coated radial ceramic product with lead-free terminations in March, 2004<sup>1</sup>. **Aximax** conformally coated axial ceramic product is also now available with lead-free terminations. Lead-free solutions for most other through-hole devices are scheduled for release in early 2005.

For lead-free part availability and identification by product series, refer to the “**Lead-Free Termination Status**” section.

<sup>1</sup>C350s not available with lead-free terminations until March, 2005.

# Lead-Free Soldering Recommendations

Peak temperature capability is an important consideration in the transition to lead-free soldering. The chart below summarizes capability by KEMET product line.

## IR Reflow Capability

Type	Product	Series	Peak, °C
Surface Mount	Multi-Layer Ceramic	Cxxx	260
	Tantalum MnO <sub>2</sub>	T49x / T510	260
	Organic Polymer	T520, T525, T530	260 <sup>1</sup>
	Aluminum	A700	250 <sup>2</sup>

## Wave Soldering Capability

Type	Product	Series	Peak, °C
Ceramic Leaded	Aximax Conformally Coated Axial	C4xx	260
	Golden Max Conformally Coated Radial	C3xx	260
	Commercial Molded Radial	C052, C062, C512, C522	260
	Commercial Molded Axial	C114, C124, C192, C202, C222	260
Tantalum Leaded	Hermetic Sealed	T1xx, T2xx	260
	Molded Axial	T322, T323	260
	Molded Radial	T330, T340, T370, T378	260
	Dipped Radial	T35x, T36x, T39x	260
	Wet Tantalum	T19x	260

<sup>1</sup>All Organic Polymer V Case product are 260°C capable per JEDEC J-020C. All remaining case sizes are currently capable only to 250°C peak. These products are planned for 260°C capability in March, 2005.

<sup>2</sup>Some Aluminum individual parts types rated for 260°C, others planned for 260°C peak capability by mid-2005. Contact KEMET sales for rating by part type.

# Backward and Forward Compatibility

Capacitors are both forward and backward compatible. This means that either lead-bearing or lead-free terminated parts can be successfully soldered in either a traditional SnPb soldering process or a lead-free soldering process. KEMET has qualified their product offerings using the Automotive Electronics Council AEC Q-200 qualification plan as a guideline.

## End of Life for Lead-Bearing Devices

KEMET has no plans to discontinue production of devices available with lead-bearing terminations. We plan to offer these products for customers who require them as long as there is ample demand. Should this decision be reversed at some point in the future, it will be clearly communicated well in advance.

# Tin Whiskering Evaluation



Tin whiskering is not a performance issue when using KEMET ceramic (MLCC) or molded case (Tantalum MnO<sub>2</sub>, Polymer KO-CAP, or Aluminum) surface mount capacitors with 100% matte tin termination finishes in either traditional tin-lead (245°C peak) or lead-free (260°C peak) soldering processes. After 500 thermal cycles, whisker density of MLCC's using lead-free and tin-lead solder was found to be 1 over an area of 250 µm x 250 µm with average length of ~2 µm. Molded case surface mount components with matte tin finish over both copper and nickel underplates remained virtually whisker-free irrespective of the mounting method used. Additionally, static aging at 55°C and 85%RH for 3 months resulted in no whisker growth on either type of capacitor. KEMET results through 6 month static aging and 1,000 hour thermal cycling results continue to show solid performance.

# Halogen Content

KEMET has taken a proactive approach to use halogen free encapsulants on molded capacitor products. While the brominated flame retardants historically used in our molding compounds are not banned, we realize that halogen free epoxies are a more environmentally friendly alternative. Our Tantalum MnO<sub>2</sub>, Organic Polymer, and Aluminum products do not contain brominated flame retardants in the molding compound. This encapsulant has been qualified for use in our ceramic through-hole products and will follow on tantalum through-hole products in early 2005.

## KEMET Tantalum is "Green"

KEMET requires its suppliers to certify that their coltan ore does not originate from Congo or bordering countries. Coltan is refined to make metallic tantalum used in the manufacture of capacitors. Environmental concerns over coltan mining in the Congo region center around forestry devastation and population impact to endangered elephant and gorilla species. KEMET does not support these activities and will not purchase raw material supporting it.

# Material Declarations



KEMET supports material declaration entries in both IMDS and Compliance Connect. In addition to engineering calculations based on raw material formulations, KEMET tests products to assure banned substances are not present.

## Need to Know More?

For further information or if you have specific questions, please address them to the KEMET CapMaster at [www.kemet.com](http://www.kemet.com).