EPOXIES
INNOVATIVE BONDING SOLUTIONS ETC.

Managing Heat Transfer with Potting and Encapsulating Compounds

Today's electronic designs are smaller in size and deliver more power, which requires that they run at higher temperatures. In order to maintain long life and high reliability, they must be able to dissipate that heat efficiently. Fans, vents and other cooling devices take up valuable design space and require additional power to operate. Molded plastics are used in place of metal enclosures due to cost control and weight savings. In most cases, these plastics are not as effective at transferring heat away from its source. Thermally conductive potting compounds are an effective way to control heat build-up in an electronic assembly.

Epoxies, urethanes and silicones are used to bond heat sinks, encapsulate power supplies and individual components and protect motors from overheating.

Thermal conductivity (k) is the property of a material that indicates its ability to conduct heat. Air and other gases are poor conductors of heat (good insulators). Metals such as silver and copper are generally the best conductors of heat. Diamond has the highest thermal conductivity value.

Thermal conductivities of common materials used in electronics assemblies

Material	**W/m degK**
Diamond	2300
Silver	410
Copper	390
Aluminum	205
Nickel	95
Silicon	84
Carbon	53
Solder	36
Alumina	21
Silver Filled Epoxy	7
Hi Thermal K Epoxy	2.2
Calcium Carbonate	1.8
Silica	1.4
Water	0.6
Unfilled Epoxy	0.4
Air	0.1

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Because of their electrical conductivity and high cost, metals are generally not a good choice for addressing a heat transfer challenge in an electronic assembly such as a printed circuit board with transformers or a power supply attached. **Epoxies, Etc…** incorporates non-electrically conductive fillers in its epoxy, urethane and silicone formulations. Thermally conductive potting compounds provide an efficient pathway for heat to travel uniformly away from a heat-generating source to a metal enclosure or to air. Additional benefits from the use of these products are: outstanding electrical insulation, better thermal shock resistance, lower shrinkage and thermal expansion and more security and protection of intellectual property. A thermally conductive adhesive will provide a permanent bond between a power supply or IC and a heat sink.

The selection of the appropriate thermally conductive potting solution involves many factors:

• Temperature range of use – What is the expected operating range of the device?
  - High temperature applications may require the selection of a heat cured epoxy or a silicone. In cases where a device may see extreme cold or thermal shock, a urethane may be a better choice. ***Products to consider – 50-3100, 50-1225, 50-2366FR***

• Other environmental conditions – Humidity, sunlight, chemical exposure?
  - A urethane would normally have better hydrolytic stability, while an epoxy based potting compound is recommended for any chemical exposure. ***Products to consider – 50-2366FR, 50-3182***

• Area to be potted – Will it be a large box or complex design with narrow spacing between components?
  - Large masses can generate too much heat and lead to other performance issues. If there are many wires or crevices, a low viscosity compound may be necessary. ***Products to consider -50-3151FR, 50-3170, 50-2366FR***

• Other regulatory requirements – UL94 V-0, RoHs, NASA outgassing, military specifications etc?
  - Most consumer electronics require agency approval. ***Products to consider – 50- 3150FR, 50-3185***

In addition to these factors, it is always important to consider the processing conditions. For example, will a one-component or two-component material be used? Will the material be machine dispensed or mixed by hand. Heat may be required for curing some products. If heat is required you need to establish the temperature and cure time.

Epoxies, Etc… has formulated a number of thermally conductive potting compounds and adhesives specifically for use in a broad range of electronics applications. These products, when used in conjunction with several different curing agents, will satisfy the vast majority of

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requirements for heat transfer in electronics. They are made up of epoxy, urethane or silicone resins. Viscosities range from very low to paste-like. Cure can be achieved at room temperature or as high as 150 degrees C.

These products are also free of solvents and RoHS compliant.

Epoxies, Etc… technical service engineers are able to make product recommendations based on the potting and production requirements of the specific application. When necessary, custom formulations are also developed at the ISO 9001:2000 certified Cranston, RI facility.

For more information, contact: Epoxies, Etc… 21 Starline Way, Cranston, RI 02921, Tel 800-Epoxies (376-9437) Fax 401-946-5526, www.epoxies.com

IMPORTANT:

Read the Material Safety Data Sheet (MSDS) before using any of our products for specific hazardous warnings. The information in this brochure is based on data obtained by our own research and is considered accurate. However, no warranty is expressed or implied regarding the accuracy of these data, the results to be obtained from the use thereof, or that any such use will not infringe any patent. This information is furnished upon the condition that the person receiving it shall make his own tests to determine the suitability thereof for his particular purpose.

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