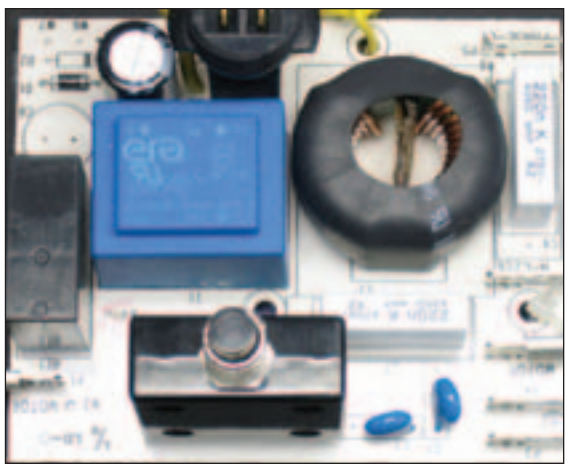
Power Supplies & Converters

Epoxy-Encapsulated Power Transformers Perform in Tough Environments



Alutron central vacuum system module.

By Adrian Carson

Small power transformers play an extremely useful role in a range of products. They show up in electronic devices, industrial equipment and household appliances — wherever there is a need to reduce line voltage to a lower level. To enhance the performance and reliability of these transformers, manufacturers keep improving them. One of the most significant innovations has been the introduction of epoxy encapsulation for small transformers.

Originally introduced in Europe — where they currently command approximately 80 per cent of the market for transformers in the under-10 VA range — epoxy-encapsulated transformers offer a number of advantages over traditional open-core designs. The most obvious arise from the physical protection that the encapsulant and outer casing provide to the windings, core and lead connections. Since the internal components are sealed inside a tough, waterproof casing, encapsulated transformers are a clear choice whenever these components might be exposed to moisture, dust or other environmental threats.

The casing and encapsulant provide physical support for the internal components — so these transformers are resistant to mechanical damage, shock and vibration. In addition, encapsulated transformers are suited for automated assembly processes, since their simple, regular shapes make them easy to grip and manipulate.

Keith Robertshaw, engineering manager at transformer manufacturer TransEra Electronics of Waterloo, Ont. explains that epoxy encapsulation also has strong advantages in the areas of thermal and electrical performance. "The epoxy material used to encapsulate the internal components has a high coefficient of thermal conductivity — and is very effective at dissipating heat away from the windings and core," says Robertshaw.

This 'thermal management' feature reduces winding temperature differentials and allows the transformers to be used in higher ambient temperature environments without exceeding allowable temperatures for the insulation class. The epoxy encapsulant also increases electrical insulation reliability when compared to tape or paper insulation. "Our encapsulated products typically exhibit superior surge voltage withstand and high breakdown voltage," says Robertshaw.

At TransEra — which manufactures 20 million transformers per year, making it the world's market leader — all production is subjected to a 4000V hi-pot test between primary and secondary windings. Because there is no air around the windings, there is reduced potential for corona under high voltage surge conditions.

The encapsulation process is less likely to damage windings than tape or paper wrapping, so that very fine gauge magnet wire can be used successfully. This way extremely small transformers can be designed to have high internal resistance in the windings and to meet Class 2 requirements for current and temperature limits under short circuit conditions, without the need for fuses or other current-limiting devices.

Building a Better Transformer

Leading manufacturers of epoxy-encapsulated transformers, such as TransEra, have invested heavily in sophisticated production facilities. Steps such as winding of the magnet wire, soldering of magnet wire to connecting pins/leads, preparation of the core, encapsulation and final testing are fully automated. The potting material (or encapsulant) is an epoxy compound that is injected under vacuum conditions to ensure there are no voids or air pockets around the windings. The whole unit is enclosed in a tough plastic shell to protect the internal components and tested before it is shipped.

TransEra encapsulated transformers are available in sizes up to 50VA.The most common configurations are supplied with connector pins designed to permit installation directly onto printed circuit boards. Other configurations, typically larger, have connector tabs or wire leads and mounting flanges that make them convenient to mount on metal structures such as DIN rails.

Epoxy-encapsulated transformers from TransEra have received approvals from most major international standards agencies, including UL, cUL, CSA, VDE, CE et cetera.

Delivering the Benefits

The excellent physical and electrical properties of epoxy-encapsulated transformers mean that they can be used in the most demanding and versatile applications. For example, there is a growing trend among North American electric utilities to adopt remotely readable meters and/or meters with smart billing capabilities (i.e. the capability to separate peak and off-peak power consumption). This extra functionality is provided by integrated circuit (IC) components built into the meter housing. The transformers needed to power these ICs must be small, reliable, rugged and able to withstand temperature and humidity extremes. In addition, the transformers must be able to withstand a significant surge voltage in the event of a nearby lightning strike. Low VA epoxy-encapsulated transformers are ideal for this application.

Close to home, another interesting application for epoxy-encapsulated transformers can be found at Alutron Modules in the Toronto suburb of Aurora. Alutron Modules specializes in the design and manufacture of motor control modules, largely for the central vacuum cleaner industry. Because Alutron's products often operate in dusty environments with mechanical vibration and electro-magnetic noise, the environmental protection of epoxy-encapsulated transformers made them a logical choice. But technical features were not the only reason for choosing encapsulated transformers. "We manufacture a wide range of products, designed to meet our customers' exact requirements," says Jack Mawdsley, operations manager for Alutron Modules.

(Continued on page 33)

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(Continued from page 16)

"This means that we need suppliers who can provide the right component at the right price. Because of the wide range of epoxy-encapsulated transformers available at TransEra, we're almost always able to get what we need in an off-the-shelf item." And he adds: "Our experience with TransEra has been very positive. The people in Waterloo have been prepared to jump through hoops to make sure that we get the product we need, when we need it and in the quantities we need."

"Getting the right products into our customers' hands is a strategic priority for us," says Stefan Aichele, vice-president of operations for TransEra. "We do our very best to make our full range of epoxy encapsulated transformers available to all customers — large or small."

While larger volume orders are served directly by TransEra North American manufacturing and service centre in Waterloo, or the territorial distributors, small orders can be arranged through TransEra new listings with catalogue and online distributors Mouser Electronics (www.mouser.com/eramagnetics) and Digi-Key (www.digikey.com).

The full TransEra portfolio contains a selection of off-the-shelf encapsulated transformers, with power ratings that range from 0.08 VA to 50 VA, and all commonly used primary and secondary voltages. To fit different space and installation requirements, TransEra's standard transformers come in three different formats: low profile, print-line, and the extremely compact mini-line series. (The smallest units are 23mm by 22mm by 12 mm and weigh a 18 grams.)

TransEra is able to build custom versions of its transformers quickly and efficiently. Transformers with customer-specified voltage levels, power ratings or special tap configurations can be produced with an OEM's logo stenciled onto the enclosure.

transera.com

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