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Custom Magnetics: What Are They & When Do You Need Them?

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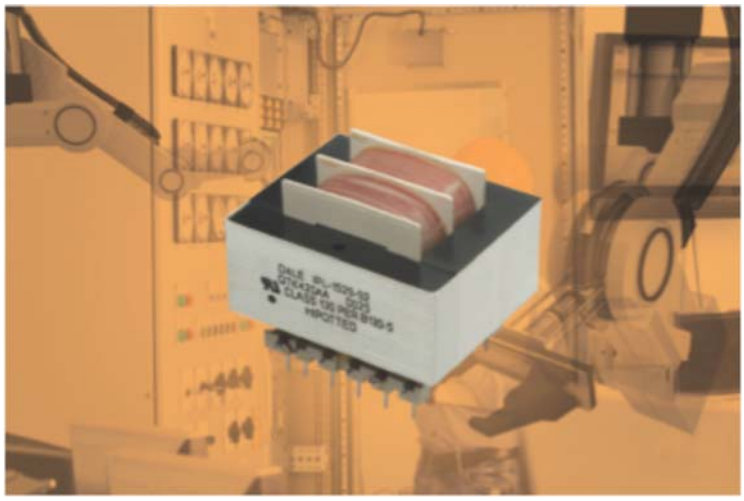
There are many manufacturers that claim they build custom magnetics. However, there is often confusion as to what constitutes custom magnetics and whether or not a designer actually needs them or can afford them. This article will clarify what custom magnetics are, help designers determine if they are needed, and explain how to engage with a custom magnetics supplier.

What is a custom magnetic device?

In the eyes of the manufacturer, custom magnetics are designed and built for one customer's specific requirements. A custom magnetic device is most often an individual transformer, inductor, or choke that is made with copper wire wound on a soft magnetic material core. The device can also be an assembly of multiple components — including inductors, capacitors, resistors, and connectors — to create a complete filter. Assemblies may include mounting features, special termination configurations, and even features to promote



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cooling.

Some custom magnetics don't have a magnetic core at all and are called "air core" devices. These are used in high-frequency applications in products such as flux antennae for telemetry transfer or wireless charging devices. Some custom magnetics can even be electro-mechanical and provide motion. Sizes vary from smaller than the head of a pin to the size of a large desk; the possibilities are endless.

When does a designer need a custom magnetic device?

Usually, the design engineer is tasked with designing a circuit that has the best-possible performance for the lowest possible cost. They will normally try to use "off the shelf" devices offered in manufacturers' catalogs or websites that have datasheets describing electrical performance and dimensions. If the design engineer cannot find any product that fits their mechanical or electrical requirements, then they have to engage with a custom magnetics manufacturer.

How much does custom cost?

In general, custom magnetic devices will cost more than standard solutions. Unless the volume is very high, they will be built with some level of manual labor and won't be fully automated, which raises costs. Designers will often times choose to compromise size, performance, or efficiency in order to utilize a lower-cost standard solution.

NRE Fees: What are they & when do they apply?

In order to provide a custom solution, the supplier may incur development, assembly tooling, and custom magnetic core tooling costs. These costs are typically passed on to the customer in the form of non-reoccurring engineering (NRE) fees, which are generally one-time fees paid up front by the customer to the supplier.

However, some suppliers offer the option to amortize them into the cost of the custom magnetic device. In most cases, the design of a device remains confidential between the supplier and the end customer. It is always wise to have a signed mutual non-disclosure agreement (NDA) in place between the supplier and the customer to insure protection of the confidential information for both parties.

What information does your custom manufacturer need to know?

Image courtesy: VIshay

There are several approaches that can be taken when contacting a custom magnetics manufacturer.

1. **Build-to-print specifications:** Some design engineers have experience with inductors and transformers and can provide detailed specifications that include values and tolerances for rated current, inductance, DC resistance, leakage inductance, turns ratio, primary / secondary voltage, etc. They also specify exact magnetic core shapes and materials, and can provide detailed dimension specifications. They often provide 2D or 3D drawings and test requirements. Everything is spelled out for the custom magnetics manufacturer and there are typically few questions that arise from the manufacturer to the customer.

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2. "**Black box" requirements:** At the other end of the spectrum, the design engineer may only have "black box" requirements with input / output voltages and currents (in the case of a transformer) or just an inductance and rated current specification (in the case of an inductor).
3. **Middle ground:** Most designers provide something in between these two extremes.

A custom magnetics manufacturer does not expect the customer to be an expert on designing or building custom magnetics, so most manufacturers can, and prefer to, provide design guidance that will help to create the best-performing and most cost-efficient solution for the customer. Good communication between the design engineer and the manufacturer's engineer is required for the best results.

Many custom magnetics manufacturers provide a design request form that will provide the basic inputs needed to start a design. Vishay offers an online version of this form for both inductors and transformers that can be filled out by the design engineer and sent by email for review. To save time, try to have as much of the requested information as possible when submitting the form.

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