

design

How to Specify a Custom Power-Supply Design

FAQs

FREQUENTLY ASKED QUESTIONS

Q: What's the difference between standard and custom?

A: Standard power supplies can be ordered from the manufacturer or a distributor using a specific part number. They are already produced, tested, and qualified, and tend to reflect the manufacturer's experience in what are the most popular performance and form-factor requirements.

Custom power supplies are any deviation from standard. This ranges from semi-custom with slight connection or voltage changes, all the way to full custom with new input and output voltages, output current levels, and features such as synchronization or output sequencing and packaging.

Q: What are the options for a standard supply?

A: Standard power supplies fall into five general categories: encapsulated; open frame; wall mount; DIN; and desktop. For a full discussion of standard power-supply options and their selection, see, "[How to Select the Right Power Supply.](#)"

Q: Why would I go custom instead of using a standard power supply?

A: While power supplies would seem to be standard subsystems, they require skill and experience to get right. The default therefore is to opt for a standard, off-the-shelf, power supply. However, if a supply can't be found that meets the cost, performance, and mechanical fit for the design at hand, a semi-custom or full-custom design may be required.



There are a number of critical steps that need to be taken between deciding to do a custom design and getting to production. It can take up to six months, so give the power supply careful consideration early in the system design cycle. (Image source: Wall Industries)

A custom design may also be needed if a system designer needs to ensure that a power supply does not change in any way in the future, as a manufacturer cannot make any changes without first notifying the customer. The design is deemed "locked in."

Q: What are the pros and cons of a custom versus standard design?

A: Along with being tested and coming with agency approvals, the pros of a standard power supply include no development or NRE costs and a shorter lead time. On the con side, it may not be exactly what's needed and some compromise on form factor and specifications may be required. For example, some performance specifications may end up being overkill, which can lead to higher costs for repair or replacement in the long term.

The upside of a custom design is that the power supply is a perfect match for the application. The downsides are the higher costs of design and agency approvals, and the longer lead time.

Q: How do I go about specifying a custom design?

A: The first items to clarify are the key requirements, such as input voltage, output voltage, output power (or current), form factor, mounting requirements, and application-specific agency approvals. These can include ambient, vibration and ruggedness for military and industrial applications, as well as safety for medical power supplies.

Keep in mind that AC power supplies and some DC-DC converters

need to be UL qualified so an additional -10% and +6% will get added to the input range: 100 to 250 Vac becomes 90 to 264 Vac input. Be aware of this UL tolerance increase so as not to over-specify the input range, which will lead to added cost. Most AC input supplies are “universal input,” meaning the supply will operate from 90 to 264 Vac, but be UL rated at 100 to 250 Vac. Any increase beyond this limits results, and may result in a custom design.

If there are special transient-voltage requirements, keep these separate from the continuous input-voltage specification. Any transient over and under voltages can be handled more efficiently and cost-effectively using other circuitry, rather than by over-specifying the input range.

Q: For the output voltage, the most important consideration is overall output-voltage tolerance: How much can the output voltage vary over all conditions of line, load and temperature and initial set point?

A: The output current should be specified as a maximum, including conditional maximums. For example, the supply needs to deliver x (current) for Y (time), or perhaps x (current) at startup or under certain conditions at a certain duty cycle.

Also, understanding and specifying the difference between peak current and average current can help reduce the size of the converter.

Other considerations include:

- Turn-on/turn-off voltage (for battery-driven supplies).
- Output voltage: Define the output voltage tolerance clearly (over line, load, temperature ranges, and initial set point).
- Be ready to discuss cooling and thermal-management options, as well as connector and hookup requirements.

Q: I'd like to opt for a custom design. How do I make maximum use of a custom design team?

A: A good design team will be able to help balance a “dream” power supply with a more realistic specification that will hit the cost/performance sweet spot. They can also discuss future designs and any power commonalities. It may be that with a few tweaks one

custom power supply could meet current and future needs.

The custom design team can also figure out where to cut costs, correctly, such as in not over-specifying a supply, while also providing the foresight to avoid being designed into a corner.

It's important to pick a design team from a manufacturer that does both custom and standard power supplies. They will be more likely to guide a customer more objectively up and down the curve from custom, to semi-custom or even back to a standard supply, if that ends up being the optimum solution.

Q: How do I cost this out?

A: After discussing the design with the custom design team, it falls to them

to come up with the cost estimate. In the meantime, designers should shop around to find their comfort level with price, as well as their confidence level in the design team. To that end, have a list of key specifications and hold each design house to those specs for an apples-to-apples comparison. Also, make sure the design house can meet the design schedules.

Q: Speaking of schedules, how long will it take for a custom design?

A: Generally, a fully custom design can take two to three months to get to a prototype and up to six months to get to full production, including agency approvals. Don't wait until the last minute to consider a custom supply. ■

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