

# The Power-Supply Conundrum: Make or Buy?

Sponsored by Digi-Key and CUI: For today's power designers, oftentimes the complexity of meeting regulatory standards makes the choice an easy one.

For many if not most electronic engineers, the power supply of your product isn't your primary focus. Your priority concerns are the features, specifications, capabilities, cost, and performance of that product. Nonetheless, all designs need a power supply.

At some point you must get around to specifying your power needs and deciding how to meet them. The big decision is whether you make the power supply yourself or buy one? That choice has become easier over the years: These days, buying an off-the-shelf power supply is an increasingly good decision. Here's a look at this perpetual power-design dilemma.

## Specifying Your Power Supply

If you save the power-supply decision until the last part of your design, you should know what kind of power supply is needed. Most will be the ac-to-dc type, but you may also need multiple supplies, a dc-dc converter, or some special supply. For this discussion, assume an ac-dc supply. The basic physical form factors include:

- Chassis mount (independent mount inside the product enclosure)
- Open frame (PCB mount)
- External desktop (separate housing with ac line cord and separate dc cable)
- DIN rail (popular mounting system for industrial products)
- Wall adapters (power supply contained within the plug-in module)

Next, the basic specs to be concerned about are:

- The ac input voltage range
- The dc output voltage
- Maximum output current
- Total available power
- Ripple maximum
- Line and load regulation percentages
- Linear vs. switching circuit topology
- Physical specifications

These are obvious. But today, you have to worry about some

of the more subtle specifications or features. For example:

- Environmental, temperature range, humidity, etc.
- Efficiency percentage
- No-load power consumption
- The need for ac isolation
- Overvoltage, overcurrent, and short-circuit protection
- Compliance with regulations, safety, and EMI

Are you prepared to design a power supply that meets your specs and features? Have you actually designed power supplies before?

Power supplies were once easier to deal with. You specified a transformer, built a diode rectifier, added a big filter capacitor, and finished off the supply with an IC regulator. It wasn't that difficult. However, today there are so many other considerations.

For instance, it's politically correct to be "green," so efficiency and no-load power consumption are main concerns. Therefore, a switch-mode power supply is a must. Those complex supplies generally require special design experience. Other factors to worry about are some reliability requirement (MTBF), safety issues, or EMI/EMC regulations to meet. Those take time to address and the related external testing is expensive.

With all this to consider, how can you decide *not* to acquire a commercial power supply that already meets those specs and conditions? That said, there may still be some special conditions or situations where you must design your own supply or have it designed in-house by an experienced colleague. Just be sure to focus on cost, time, available design expertise, and special needs.

## Power-Supply Design Requirements

While you may be able to design your own supply, keep in mind that it still must be tested and certified.

Even if you're a good power-supply designer, outside influences upon your design must be considered. In our highly regulated world today, many electrical and electronic prod-

ucts must be tested for safety and electromagnetic compatibility (EMC).

For example, a product must meet electromagnetic-interference (EMI) regulations of the Federal Communications Commission (FCC). These are defined in the Code of Federal Regulations (CFR) 47, Parts 15 and 18. Underwriters Laboratories (UL) is another one of the two key regulators in the U.S. You also need to factor in Canadian and European regulators.

### Certifying Agencies

Agencies that require testing and certification of electrical and electronic products before they can be sold include:

- Canadian Safety Association (CSA)
- European Committee for Electrotechnical Standardization (CENELEC)
- European Standards (EN)
- European Telecommunications Standards Institute (ETSI)
- Federal Communications Commission (FCC)
- International Electrotechnical Commission (IEC)
- Underwriters Laboratories (UL)

One of the key new standards that must be met is IEC 62368-1. This hazard-based safety standard replaces older IEC/EN/UL/CSA 60950-1 standards for information technology equipment (ITE) and EN 60065 for audio/video (AV) equipment. The new standard, which is expected to provide greater flexibility in product design that includes the latest technology, goes into effect on December 20, 2020.

If you decide to buy an off-the-shelf supply, your next step is to identify vendors and/or distributors. There are many suppliers to choose from. Select one that has a broad product line so that it covers your needs. CUI Inc.'s power supplies distributed by Digi-Key are a good starting point.

### A Typical Product

A representative product will give you some idea of available power supplies and their features and specifications.

Consider the VOF Chassis Mount Power Supply Expansion Series VOF-30C. Packaged into an industry-standard 2- × 3-in. size module, this open-frame model is a switch-mode supply that features a switching frequency of 60 kHz. Fixed standard output voltages range from 3.3 to 48 V. The 12-V model has a maximum output current of 2.5 A. The whole supply is rated for 30 W. Other useful specs are an output ripple of less than 100 mV p-p and an efficiency of 84%.

As for ac input, the supply can accommodate voltages from 85 to 264 V at a frequency from 47 to 60 Hz. The supply is regulated with a line regulation of  $\pm 0.5\%$  and a load regulation of  $\pm 1.0\%$ . The dc voltage setpoint accuracy is  $\pm 2\%$ .

The supply comes with standard protection features such as overvoltage, overcurrent, and short circuit. Finally, the supply meets over a dozen standard safety and compliance regulations. Check the datasheet for details.

Some highlights of popular CUI power supplies include:

- VOF-S60B-PB offers a peak power function, which allows the power supply to deliver up to 2X its rated power for up to 10 seconds.
- Open-frame modules offer high efficiency, up to 94% in some models.
- CUI's next-generation VOF open-frame ac-dc power-supply series delivers higher efficiency and improved no-load performance to meet the growing demand for green power technology
- The VOF-15C and VOF-30C series are also designed to meet UL/EN/IEC 60335 requirements.
- Many CUI products already meet the new 62368-1 standard.

### Related References:

- [IEC 62368-1: An Introduction to the New Safety Standard for ICT and AV Equipment](#)
- [Product Highlights: Open Frame AC-DC Power Supplies](#)



