

Power Interfaces

Power interfaces are required when external power sources like solar panels, fuel cells, or batteries are used to generate power for electrical devices. There are two major power interfaces commonly used, direct current to direct current (DC/DC) converters and direct current to alternating current (DC/AC) inverters. While both interfaces are designed to convert from variable DC inputs, they output to different power standards and power levels that are used in different applications.

DC/DC Converters/Regulators

DC/DC converters are electronic circuits that convert DC sources from one voltage level to another. Most DC/DC converters also regulate the output voltage. They are important in many power management and conversion applications of electronic devices in the automotive, telecommunications, industrial, medical, computing, military, and high-end consumer markets. These devices often contain several sub-circuits with voltage levels sometimes higher or lower than those supplied by the battery or external supply. Additionally, a battery voltage source declines as its stored power is drained. DC/DC converters offer a method to increase voltage from a partially lowered voltage source without using multiple power sources and with a smaller footprint.

Based on the applications using DC/DC converters, regulators with different conversion methods can be selected to provide high quality, high performance, compact, efficient, and cost effective power supply solutions. The two most commonly used DC/DC regulators are:

Linear Regulators

Linear regulators only output voltages lower than the input. They are very inefficient when the voltage drop is large and the current high since they dissipate power equal to the product of the output current and the voltage drop as heat. Consequently, they are not normally used for large-drop high-current applications. However, they are inexpensive, much smaller in size, reliable (if good heat sinking is used), and can provide low noise output voltage.

Switching Regulators

Switching regulators convert one DC voltage level to another by temporarily storing the input and releasing that energy to the output at a different voltage. The storage may be either in magnetic field storage components like inductors and transformers, or in electric field storage components like capacitors. This conversion method is more power efficient (often 75% to 98%) than linear voltage regulation and is beneficial for increasing the running time of battery operated devices.

Additionally, recent technical achievements in the performance of switching regulators and innovative packaging methods have finally allowed a new generation of smaller module point-of-load DC/DC regulators. All circuit components, such as the inductor and power MOSFETs, can be reduced in size and encapsulated into the tiny format of a surface mount component (Figure 1).

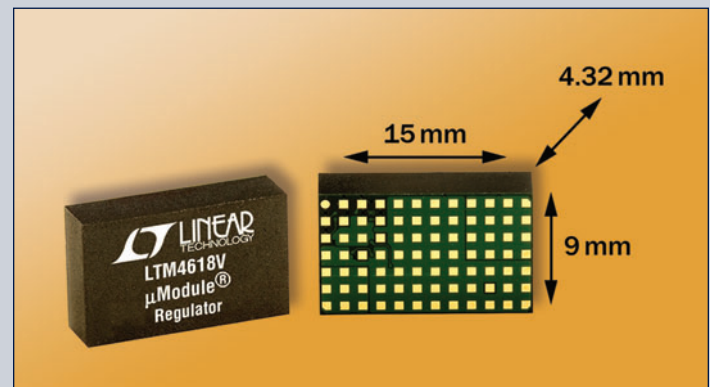
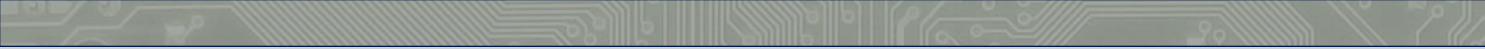


Figure 1: Linear Technology's point-of-load DC/DC regulators can be packaged in a smaller module. Photo appears as a courtesy of Linear Technology.

DC/AC Inverters

DC/AC inverters are devices designed to convert power that is produced by batteries, solar panels, and fuel cells to the standard



power needed to run electrical equipment. The converted AC can be any required voltage and frequency with the use of appropriate transfer, switching, and control circuits.

Power inverters produce wave signals of three different qualities of power output.

- Square wave signal inverters. Square wave signal inverters are neither reliable nor consistent.
- Modified square (or sine) wave inverters. Modified square wave inverters are the most popular and produce efficient stable power that can run most standard electrical equipment.
- Pure sine wave inverters. Pure sine wave inverters produce the most reliable and consistent power wave signal and are the most expensive to acquire. Rechargeable tools and medical equipment that are sensitive to input power quality require pure sine wave inverters.

Commercial off the shelf (COTS) inverters and industrial power inverters can be easily found in the marketplace. It is important to verify that the output quality and capacity of an inverter unit suits the maximum current requirement of the electrical equipment to be powered.

ACI Technologies is involved in a number of projects that require the design of power interfaces. For more information on selecting and designing power interfaces, please contact the ACI Helpline at 610.362.1320 or via email to helpline@aciusa.org.

Reference

1. Power Inverters. Web. <<http://www.powerinverters.org/>>.

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