An introduction to 2 in-1 AC-DC power bricks

Abstract

Operating reliably in extreme ambient temperatures is no small task for AC-DC power supplies with PFC, especially when they are employed in indoor and outdoor-mounted electronic equipment where compact size is mandatory. David Buck of TDK-Lambda introduces a new 2-in-1 PCB power brick solution that can provide usable DC power from half the size of a traditional two-brick solution.

Introduction

Compact DC-DC converters have made their way into millions of electronic products and systems. The vast majority of these depend upon an AC front-end power supply "box" to convert the AC power source into a DC voltage from which the converters operate. Regulations have required that these front-end boxes include Power Factor & Harmonic Correction (PFHC). Add to this the need to achieve compact size and often operate with severe ambient temperature extremes and the designer is faced with a problem that is not easily solved.

Traditional Distributed Power Solutions

Traditional designs that employ distributed power architecture place non-isolated DC-DC converters on PC boards very close to the point-of-load (POL) to maximise system speeds and efficiencies. These are fed from a high power isolated DC-DC also PCB mounted. These isolated converters will be typically supplied with 48V or 24V from a fan cooled AC-DC power supply with PFHC mounted somewhere in the system's enclosure, external to the main PC board (Figure 1).

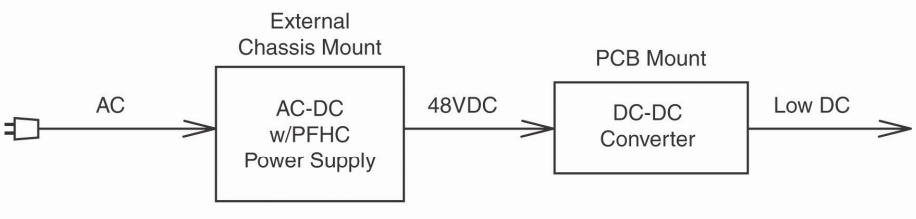

FIGURE 1

This technique is quite practical for most applications. However, when it comes to equipment that must be situated in an outdoor enclosure and occupy the smallest possible volume a complete ‘’brick‘’ based solution is the most common method used.

Improved Power Distribution Methods

Major manufacturers of DC-DC converters, such as TDK-Lambda, have been providing AC input PFHC front-end modules with high voltage (typically 360V) dc output that are PCB mountable. These modules supply typical high power (400-700W) DC-DC converters packaged in half and full “brick” sizes that can accept high voltage input (between 200V and 400V). This has the advantage of placing all the power components on the same pc-board thus reducing the end product’s size and eliminating the power interconnect wires (Figure 2).

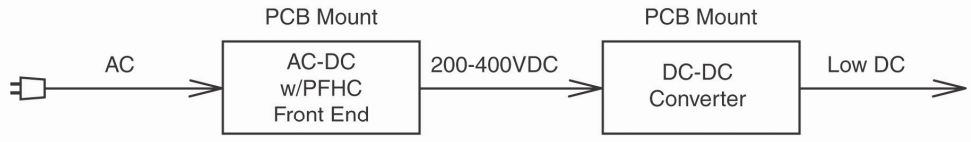

FIGURE 2

These AC-DC w/PFHC front-end modules require some external passive components (storage and filter capacitors, etc.), but the space required for these items is small in comparison to the elimination of the external metal cased AC-DC power supply and, these external components can be inserted automatically during the production of the pc-board. An added advantage of using modules is that they are base-plate cooled and, therefore, fans can be eliminated with cooling effected by means of heat sinks or conduction through the system’s metal enclosure.

New 2-in-1 AC-DC Power Bricks

Recent advances in components and power design technologies have made it possible to shrink the ‘’two brick‘’ solution into much smaller ‘’ 2-in-1‘’ PCB-mount power bricks.

In order to increase power densities, special permalloy cores have been developed and employed in the inductors. New substrates and innovative transformer winding techniques have facilitated component height compressions and improved thermal management. And, of course, advances in integrated and hybrid circuits have contributed greatly to this next generation of power products.

TDK Lambda’s PFE series of integrated 2-in-1 AC-DC power bricks represents the new breed of technologically advanced power supplies being introduced to the market. Suitable for both indoor and outdoor applications, these modules have already been designed into a number of industrial, datacom and telecom applications – particularly where high operating temperatures are encountered.

All versions have a wide-range AC input that allows operation from any voltage between 85V and 265V at 47 to 63Hz, and active power factor correction is incorporated as standard. All PFE models are delivered with TDK Lambda's two-year warranty, are safety-approved to UL60950-1, CSA60950-1 (cUL) and EN60950-1, and carry the CE mark.

All this is accomplished within the same size constraints of a single full-brick package, thus providing a 50% board space saving over traditional solutions (Figure 3) and generates usable DC output for the system.

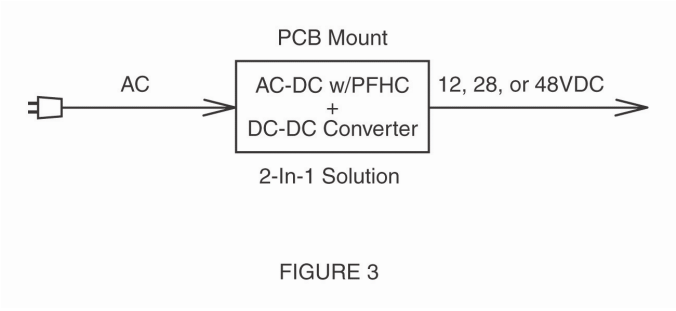

FIGURE 3

The fully-regulated PFE300S and PFE500S models are available in 12, 28 and 48V nominal outputs and can be adjusted over a ±20% range. The 12V versions deliver 396W with a maximum base-plate temperature of 85°C, while the 28V and 48V models provide 504W at 100°C base-plate temperatures (PFE500S). Line and load regulation is 0.4%.

The 12V output models of these integrated 2-in-1 PCB-mounted power bricks are ideal for Distributed Power Architectures because they can drive POL converters directly. With no intermediate bus voltage needed the use of multiple low-cost, non-isolated POL converters (Figure 4) in conjunction with the combined AC-DC module offers significant cost savings and improved efficiency.

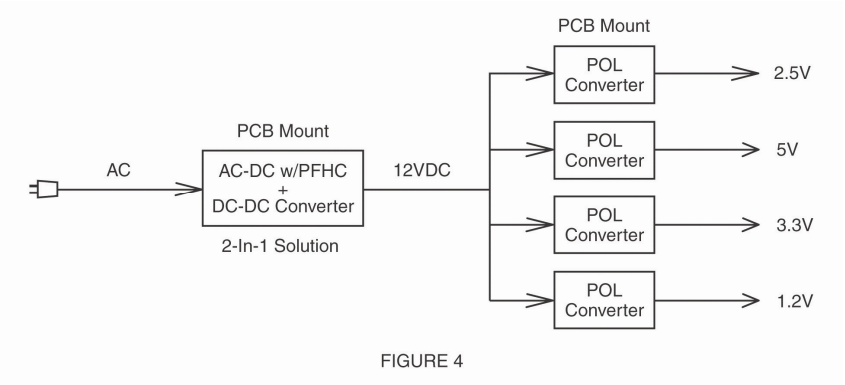

FIGURE 4

The semi-regulated PFE700S can deliver 714W with a nominal output of 51V and can be operated as an intermediate bus converter powering regulated DC-DC converters for multiple output applications. Maximum base-plate temperature is 100°C, derating linearly to 85% load above 85°C. Line and load regulation for the PFE700S is 4V.

TDK Lambda's new PFE500F versions – in a slightly larger package (70 x 122 x 12.7 mm) – combine the well-established all-in-one solution of the existing PFE modules with added functionality. The output current balance connection enables up to six PFE500F units to be paralleled together to accommodate increased power requirements. In addition, remote on/off control and inverter operation good (IOG) functions provide greater flexibility in start-up or shutdown sequencing and fault diagnosis of the power system. An auxiliary supply rail (12V, 20mA) is also provided for external signals.

A further benefit is that with such a line-up of onboard modules in its portfolio the range and flexibility of special customer specific assemblies that TDK-Lambda can offer is vastly increased.

The fully-regulated PFE500F models are also available in 12V, 28V and 48V nominal outputs and can be adjusted over a ±20% range. The 12V PFE500F delivers up to 504W with a maximum base-plate temperature of 85°C, while the 28V and 48V models deliver the same output at temperatures up to 100°C. Line and load regulation is 0.4%, and efficiency exceeds 83% in all versions.

For further information

To learn more about the PFE series, please visit:
http://uk.tdk-lambda.com/pfe

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