Package, Power, Board Space are the Design Considerations

By Paul Knauber, Murata Power Solutions

Selecting the best isolated brick DC/DC converter for an application can pose a challenging task for the design engineer. There are a number of circumstances that can motivate a particular choice. These could be transient response, efficiency, environmental conditions, or mechanical packaging. This article looks at some of the technical considerations when choosing the optimum brick converter for an application.

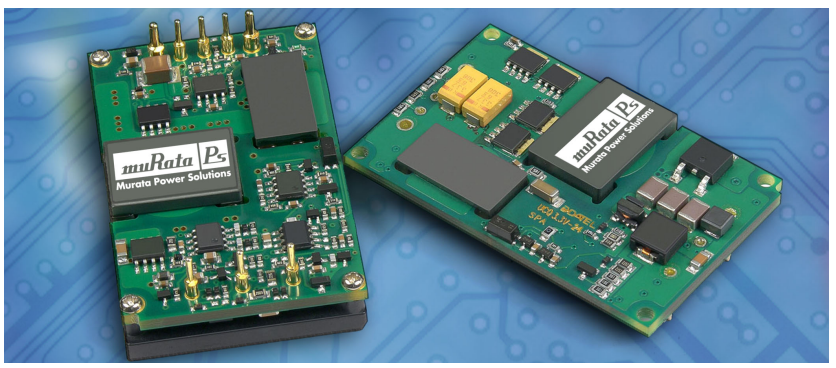

Figure 2: UCQ Single Output low profile quarter brick DC/DC converters.

Isolated brick converters are available in a range of standard formats including 1/16th, 1/8th, 1/4 and ½ bricks and full brick, with dimensions as shown in Figure 1. The choice of a specific package is typically dictated by the power level required. Technology improvements over time mean the power levels deliverable from each have increased. The first half-brick products delivered just 50W, while products delivering several hundred Watts in the same package are available today. Board space is a key consideration in selecting a converter. Designers often want the most power in the least space; however, bearing in mind that technology will continue to lead to higher power densities, some users might be wise to select quarter-brick packages whenever possible. The reason for this is that when the need for cost-reduction arises later in the product life cycle, an eighth-brick offering the same power may be available. This allows the user to drop in a lower cost converter without having to alter the application PCB. Overall height may also be important in some designs, so low profile packages like that of Murata Power Solutions UCQ series (Figure 2) can be useful. Isolated converters use a transformer so there is no physical connection between the primary and secondary sides. Isolation can serve multiple purposes including compliance with safety requirements, noise immunity, and alternate ground reference. Isolation is particularly useful in telecommunications where the source voltage is often -48V (positive ground) while most secondary voltages are configured with a negative ground. Several standards exist for isolation voltage ratings and these sometimes call for a specific class of insulation as well. Isolated brick converters are generally available with output powers ranging from approximately 50W up to several hundred Watts. Achievable power levels for any given brick form factor remain a function of the output current and voltage, the input voltage range, the switching frequency, and the conversion efficiency. For any given output voltage, the power densities continue to increase as component technologies and optimised topologies continue to drive efficiencies ever higher.

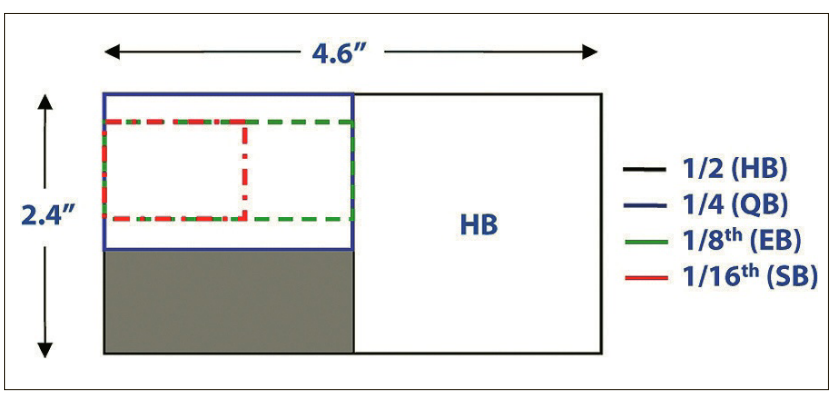

Figure 1: Isolated DC/DC converter form factors.

Thermal management

The environment in which an isolated brick DC/DC converter will be operated is perhaps the most important parameter to be fully understood. The key elements are maximum operating temperature and airflow across the converter, which can be either natural convection or forced convection airflow from a cooling fan. In applications that need to be sealed against the outside environment, fans cannot be used. In this situation, cooling in addition to natural convection can be achieved by attaching the sealed module to a baseplate, heat spreader or heatsink; cooling then occurs by conduction. For applications constrained to natural convection cooling, brick type converters must typically be de-rated from their maximum capabilities, depending upon the maximum ambient air temperature. Many of the brick type converters incorporate a baseplate for conduction cooling, or are offered with a baseplate option. The baseplate improves thermal performance when used in both natural convection and forced convection environments, but also allows units to be employed in conduction cooled applications where the baseplate is attached to a larger thermal sink, or 'cold plate'. When considering the application temperature, it is crucial to understand the temperature at the converter and not the ambient air temperature in which the converter is operating. Most isolated brick converters include thermal shutdown circuitry to protect the converter from damage under abnormal environmental excursions. These protective circuits result in shutdown of the converter with automatic recovery upon restoration of normal temperatures. Several degrees of hysteresis are added to avert oscillation.

Input voltage

Input voltage ranges for brick type converters are most typically 2:1, meaning that the maximum operating voltage is approximately twice the minimum. Typical examples are 18 to 36V and 36 to 75V. Murata Power Solutions also offers models with wider 4:1 input ranges of 9 to 36V, the UQQ series (Figure 3) and 18 to 75V. These 4:1 modules are particularly useful when system designers are confronted with the reality that their equipment may be deployed in environments where the available voltage can be quite disparate.

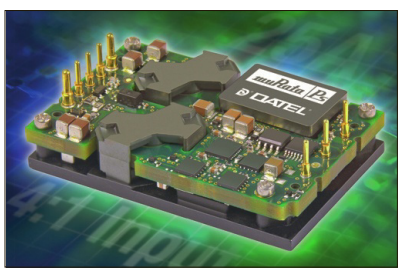

Figure 3: UQQ wide input range single output DC/DC converters.

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