

When can an isolated DC-DC converter be replaced by a non-isolated device?

For a system operating from the AC mains, the AC-DC power supply already provides the primary to secondary isolation barrier and has safety certification to the IEC standards. Hence using an isolated DC-DC converter often has no benefits to the application.

This white paper is intended for electronics engineers and designers working with Distributed Power Architectures (DPAs).

References

www.uk.tdk-lambda.com/i3A

www.uk.tdk-lambda.com/i6A

www.uk.tdk-lambda.com/products/dcdc-converters

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Some Distributed Power Architectures (DPAs) utilise 1/16th and 1/32nd “brick” package isolated DC-DC converters to step down a 24V or 48V DC source to produce 3.3V, 5V or 12V output voltages. This can be used to drive high performance Point of Load DC-DC converters capable of responding rapidly to high transient loading from FPGAs, or other devices requiring similar voltages.

Non-isolated DC-DC converters in 1/16th and 1/32nd packages are now available offering lower cost, higher efficiency, and greater output power with the ability to operate in high ambient temperatures with simplified cooling. Examples are TDK-Lambda’s i6A 250W rated 1/16th series and the i3A 100W rated 1/32nd series. These devices also have the ability to operate from wide input ranges and have very wide output adjustment.

Isolated DC-DC converters do offer an input to output isolation barrier through the use of transformers and opto-couplers. This allows the output voltage to be floating and be used as a positive or negative polarity with respect to the system 0V. The isolation barrier can, in some applications, assist in reducing electrical noise. This, however, does drive up cost, increase power losses and limit the output rating of the device.

Although the i6A and i3A are non-isolated, for a system operating from the AC mains, the AC-DC power supply already provides the primary to secondary isolation barrier and has safety certification to IEC standards. Hence using an isolated DC-DC converter often has no benefits to the application.

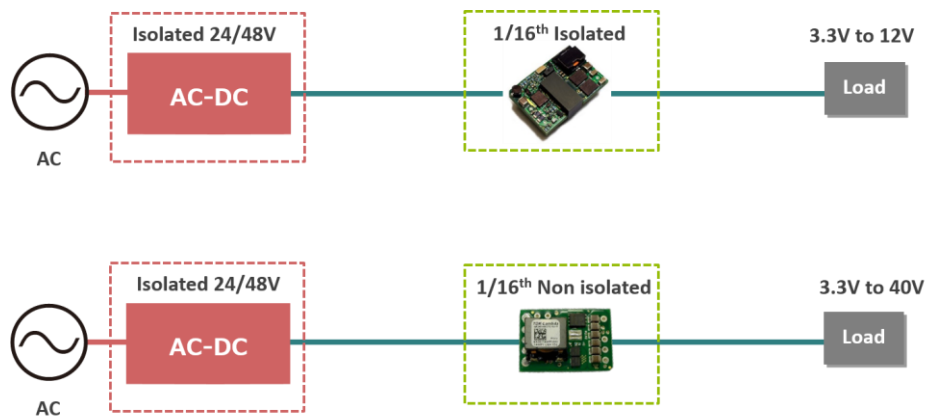


Figure 1: Block diagram

The i3A and i6A non-isolated converters have the same footprint as the industry standard 1/32nd and 1/16th converters respectively.

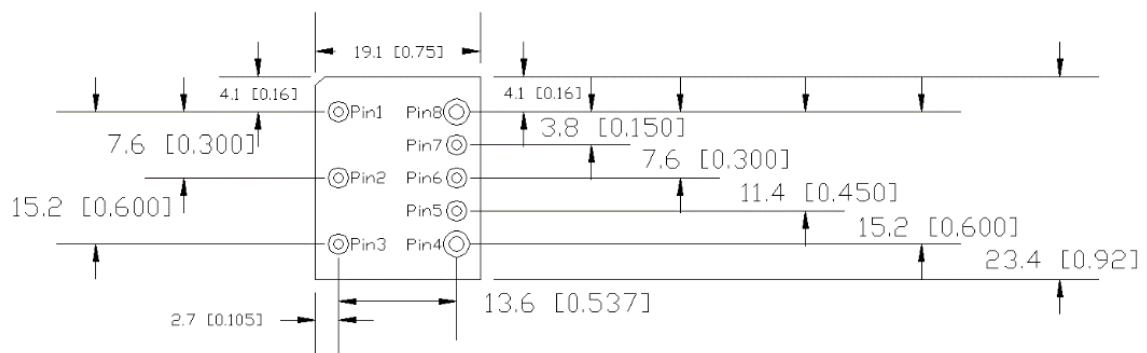


Figure 2: 1/32nd converter pin locations (top view)

All the pin connections have the same functionality, except the isolated converters have no connection between the $-V$ in and $-V$ out pins and the $-V$ sense connection is redundant. Internally, the non-isolated converters have a connection between these two pins. See Table 1, and Figures 3 & 4.

Pin Number	i3A Non-Isolated 1/32 nd	Isolated 1/32 nd
1	+V in	+V in
2	Remote on/off	Remote on/off
3	-V in and common 0V	-V in
4	-V out and common 0V	-V out
5	N/C	-V sense
6	Trim (Output adjustment)	Trim (Output adjustment)
7	+V sense	+V sense
8	+V out	+V out

Table 1: 1/32nd Pin Function Comparison (Non-Isolated and Isolated)

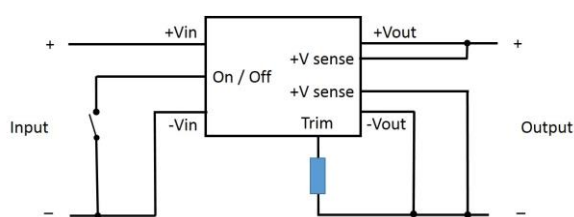


Figure 3: Isolated converter connections

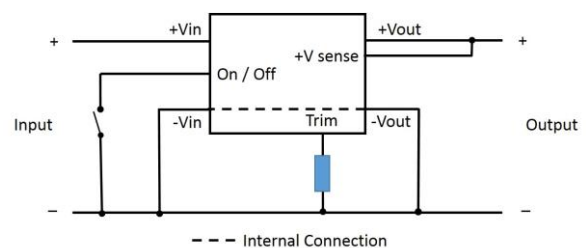


Figure 4: Non-Isolated converter connections

Specification	i3A Non-Isolated 1/32 nd	Isolated 1/32 nd
Input Voltage	9 – 53Vdc	36 – 75Vdc
Output Voltage	3-3-16.5 / 5-30Vdc	3.3, 5, 12 (-20/+10% adjust)
Output Power	100W	Up to 30W
Efficiency	Up to 98%	Up to 92%
\$/Watt Distribution 1-9 piece price	\$0.23/W	\$0.81/W

Table 2: Comparison of 1/32nd Converters

To summarise, Table 2 shows a comparison between the 1/32nd brick footprint i3A non-isolated series and a typical isolated converter series. Note that the non-isolated converters are “step down” where the input voltage has to be slightly higher than the output voltage.

For more information about the full range of TDK-Lambda i3A and i6A series of non-isolated DC-DC converters, please visit:

www.uk.tdk-lambda.com/i3A

www.uk.tdk-lambda.com/i6A

www.uk.tdk-lambda.com/products/dcdc-converters

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