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40-A Buck Converter IC Is Stackable Up to 160 A

Texas Instruments' TPS546D24A 40-A SWIFT dc-dc buck converter is said to be the first of its kind to allow stacking (or paralleling of outputs) to deliver 160 A of output. This 160 A, which is achieved at an 85°C ambient temperature, is four times what existing SWIFT chips and other competing buck converter ICs can produce, according to the company (Fig. 1). In other words, the existing 40-A buck converter ICs are not stackable.

TI also says that this PMBus-compatible buck converter has the highest efficiency of any 40-A dc-dc converter, allowing engineers to reduce power loss by 1.5 W in high-performance data center and enterprise computing, medical, wireless infrastructure, and wired networking applications.

Solution size and thermal performance are two key considerations for engineers designing power supplies for modern field-programmable gate arrays (FPGAs). With its unique stackability, the TPS546D24A buck converter addresses both. Its PMBus interface offers a selectable internal compensation network. According to TI, this compensation scheme enables engineers to eliminate as many as six external compensation components from the board and shrink the overall power-supply solution size by more than 10% (or 130 mm^2) for higher-current FPGA/application-specific ICs (ASICs) when compared to discrete multiphase controllers (Fig. 2).

In addition, the TPS546D24A achieves a low thermal resistance of 8.1°C/W and runs 13°C cooler than competing dc-dc converters, improving reliability in electronics that operate in hot, harsh environments, such as baseband units and automated test equipment. The TPS546D24A offers a switching frequency of 1.5 MHz, enabling engineers to deliver 40 A of current per IC while reducing inductance and capacitance by one-third compared to similar converters.

To mitigate the negative impact on efficiency typically associated with high switching frequencies, the TPS546D24A features a 0.9-mΩ low-side MOSFET. This low on-resistance power switch is said to enable 3.5% higher efficiency than competing buck converters. In addition, the TPS546D24A makes it easier to meet rigorous FPGA voltage tolerance requirements by offering an output voltage error of less than 1%. Furthermore, its extensive PMBus command set and pin-strapping configurability allow engineers to monitor current more accurately for fault reporting and to avoid overdesign.

The converter supports split rail operation with AVIN and PVIN pins. The AVIN pin supplies power to the chip's controller, while the PVIN pin supplies power to its power stage. The TPS546D24A's PVIN pin allows 2.95-V to 16-V input for conversion, and the AVIN pin allows 2.95-V to 18-V input for operation, and 4-V to 18-V for switching. The TPS546D24A produces a selectable 0.6-V to 5.5-V output via pin strap or 0.25-V to 6.0-V using the PMBus VOUT_COMMAND.

The TPS546D24A is available from TI and authorized distributors in a 5-mm-by-7-mm, 40-pin QFN. Pricing starts at $4.27 each in 1,000-unit quantities. The TPS546D24AEVM evaluation module is available on TI.com for $199. Pin-to-pin- and footprint-compatible, preproduction TPS546B24A (20-A) and TPS546A24A (10-A) dc-dc converters are available now, but only from TI. Unit pricing for these models starts at $3.25 and $2.49 in 1,000-unit quantities, respectively. For more information, see TPS546D24A product page.

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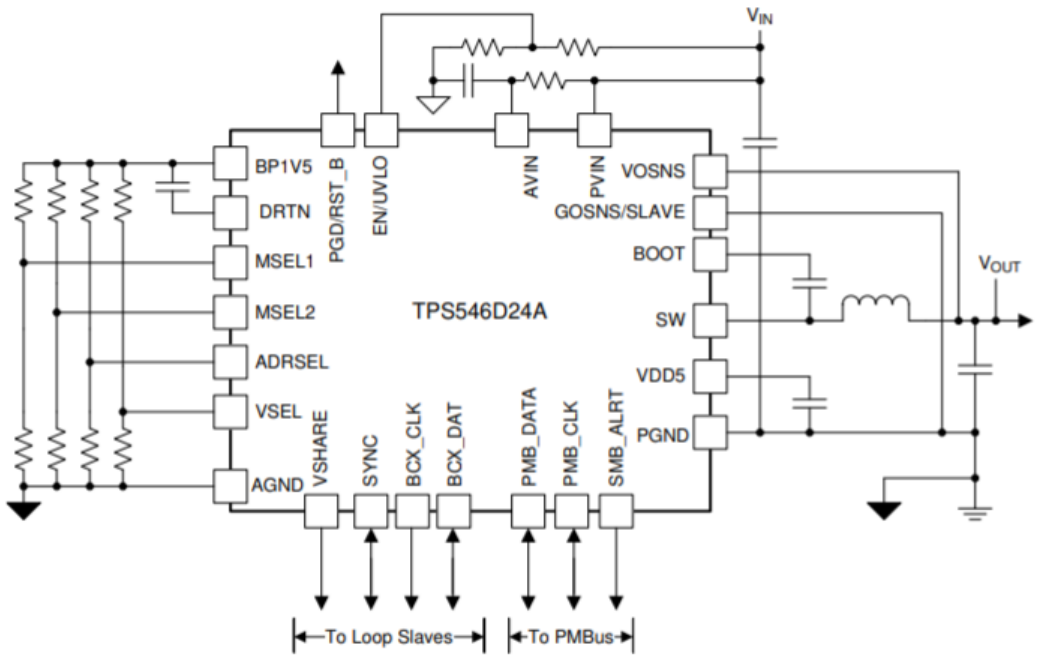

Fig. 1. A member of TI's SWIFT family, the TPS546D24A is a highly integrated, PMBus-compatible point-of-load converter capable of high-frequency operation and 40-A output from a 7-mm × 5-mm QFN package. Two, three, and four TPS546D24A devices can be interconnected to provide up to 160 A on a single output.

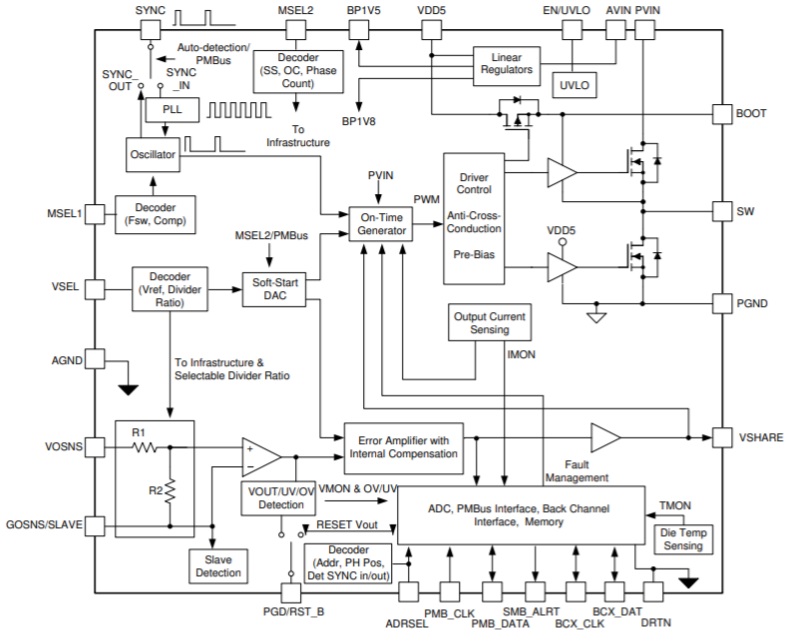

Fig. 2. The TPS546D24A uses a proprietary fixed-frequency average-current-mode control with input feedforward and selectable internal compensation components for minimal size and stability over a wide range of output capacitances.