Article on TPP36x0x Series (Part 1): Exploring Alternative Applications of TPP36x0x Series Buck DC-DC Converter ICs!

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In industrial applications, AC input is rectified to form a wide-range high-voltage DC power source. Similarly, in new energy vehicle applications, the battery pack serves as a wide-range high-voltage DC power source. Typically, they are converted to 12-V or 24-V DC power rails through flyback converters, achieving electrical isolation between input and output. In traditional fuel-powered vehicle applications, batteries mainly operate at 12-V and 24-V DC voltage levels. The 12-V or 24-V DC power rails are then converted to 5-V DC power rails using wide-input voltage DC-DC converters or LDOs. Finally, low-voltage DC-DC converters, LDOs, and PMICs are used to generate various DC rails such as 3.3 V, 1.2 V, and others.

3PEAK is continuously developing and expanding its power supply product portfolio to cater to various applications such as industrial and automotive. The TPP36x0x series buck converter products, currently in mass production, offer input voltage support ranging from 4.5 V to 36 V. They are available in three current specifications: 1A, 2A, and 3A. The series also provides three switch frequency options: 500kHz, 1MHz, and 2.2MHz. In light-load scenarios, the products support both Power Save Mode (PSM) and Forced Continuous Conduction Mode (FCCM/FPWM) to optimize energy efficiency. These features make them ideal converter solutions for various industrial applications.

The TPP36x0x series products not only serve as conventional buck topology converters but also support other multiple power supply topologies. In this article, we will briefly introduce four commonly used converter topology solutions based on this series.

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1. Classic Buck Topology

Classic Buck Topology: The typical application circuit diagram of the classic buck topology is shown in Figure1-1 below.

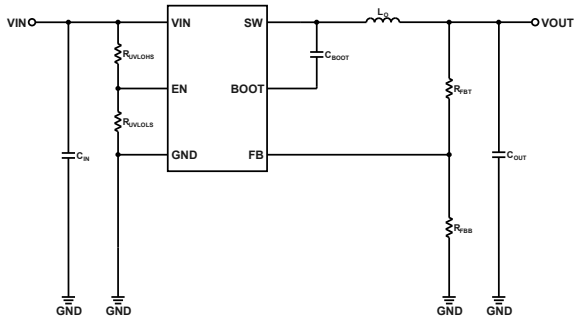

Figure 1-1

As mentioned earlier, this topology is the most common application for buck converter products and is suitable for voltage reduction solutions below 36 V. Its characteristics include the input and output voltages having the same polarity, with the output voltage lower than the input voltage. Solutions based on this topology have been widely used in fields such as photovoltaic inverters, servo drives, security surveillance, building automation, smart home appliances, and industrial automation.

2. Isolated Buck Topology (Isolated Buck)

Isolated Buck Topology (Isolated Buck): The typical application circuit diagram of the isolated buck topology, also known as Isolated Buck, is shown in Figure1-2 below.

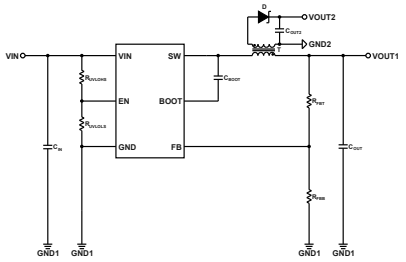

Figure 1-2

By replacing the inductor in the classic buck topology with a coupled inductor (transformer), this topology is formed. It is particularly suitable for scenarios requiring an isolated power supply for applications such as gate drivers for power-switching devices. It should be noted that this topology is essentially a buck topology, where the output voltage on the primary side is lower than the input voltage, and the output voltage on the secondary side is determined by the turns ratio of the coupled inductor.

Due to its simple structure, solutions based on this topology are preferred for wide input voltage range, low power, and small-size isolated power supplies. They are widely used in applications such as isolated gate drivers, isolated signal sampling, and isolated interfaces.

3. Classic Inverting Buck-Boost Topology (Inverting Buck Boost)

Classic Inverting Buck-Boost Topology (Input Positive Voltage, Output Negative Voltage): The typical application circuit diagram of the classic inverting buck-boost topology , which enables positive voltage input and negative voltage output, is shown in Figure1-3 below.

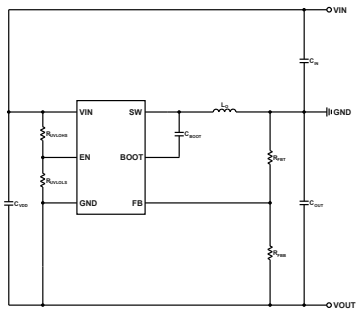

Figure 1-3

This topology, in conjunction with the classic buck topology, can generate precise positive and negative power supplies. It is suitable for scenarios where operational amplifiers or other components in the system require both positive and negative power supplies. As the name suggests, the absolute value of the output voltage in this topology can be lower than, equal to, or higher than the input voltage. It is important to note that in the application, the sum of the absolute values of the input and output voltages should not exceed the maximum recommended operating voltage of the TPP36x0x series products, which is 36 V.

4. Isolated Inverting Buck-Boost Topology (Isolated Inverting Buck Boost)

Isolated Inverting Buck-Boost Topology (also known as Flyback): The typical application circuit diagram of the isolated inverting buck-boost topology, also referred to as Flyback, is shown in Figure1-4 below.

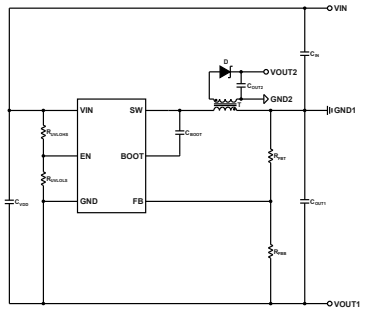

Figure 1-4

Similar to the isolated buck topology mentioned earlier, this topology is formed by replacing the inductor in the classic inverting buck-boost topology with a coupled inductor (transformer). In addition to providing electrical isolation in the output, this topology allows the shorting of the primary and secondary grounds of the transformer, enabling the generation of positive and negative power supply outputs using a single buck-boost converter. This simplifies the solution and reduces costs.

All part numbers in the TPP36x0x series support the classic buck topology, classic inverting buck-boost topology, and isolated

inverting buck-boost topology. If the isolated buck topology (Isolated Buck) is used, it is necessary to select the corresponding part number with the FPWM version. It is worth noting that in the electrical isolation output topologies, the use of coupled inductors (transformers) with multiple secondary windings can generate multiple electrically isolated output voltages from each other.