FLYBACK TRANSFORMER APPLICATION NOTES

Flyback Transformer

Flyback converters are a popular topology for power supplies <150W due to their simplistic design, versatility and low cost. Flyback converters have similar architecture and performance as the boost topology but have the benefits of a secondary winding. The secondary winding can provide galvanic isolation from the input to the output and can step up or step down the input voltage depending on the turns ratio. Flyback transformers can also have multiple secondary windings so multiple outputs can be regulated from a single source. Moreover, since the energy is stored in the transformer, no output filter is required as in other isolated topologies, so the number of components used can be reduced lowering the cost of the design.

Flyback transformers differ from other transformers since they store energy in the magnetic field rather than being transferred immediately from the input to the output. The energy is stored in the primary when the switch is closed (Fig. 2) then released to the secondary when the switch is opened (Fig. 3). Since flyback transformers can typically operate in the hundreds of kHz range, a low loss ferrite material is used and gapped to store the energy and prevent saturation.

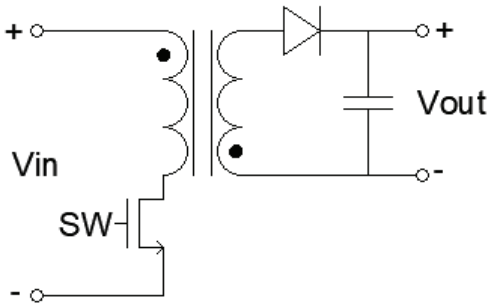

Fig. 1: Typical Flyback Converter Circuit DiagramTypical Flyback Converter Circuit Diagram

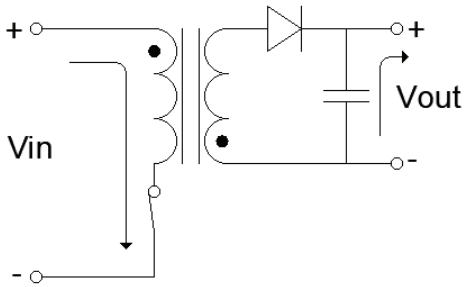

Fig. 2: Current Flow w/ Switch Closed-Current Flow w/ Switch Closed

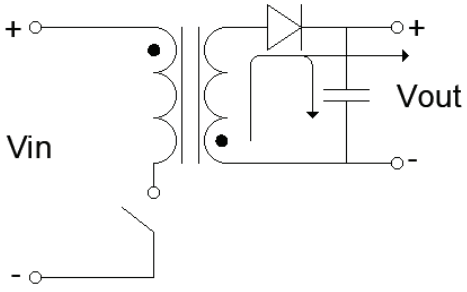

Fig. 3: Current Flow w/ Switch Open Current Flow w/ Switch Open

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2-Switch Flyback Transformer

In the traditional flyback topology, there is a high voltage stress on the primary side transistor due to the transformer leakage inductance and ringing. High voltage rated transistor can be used to handle the high voltage. Snubbers can be added to reduce the ringing, but the energy stored in leakage inductance is absorbed by the snubber reducing the efficiency. To solve this problem, a second switch can be added to the primary side of the transformer to reduce the voltage stress on the transistor. The overall voltage will be divided between the two transistors. Moreover, the energy stored in the leakage inductance can be returned to the source using two diodes.

2-switch flyback transformers work in a similar fashion as the traditional flyback transformer. Energy is stored in the primary when both switches are closed (Fig. 5) then released in the secondary when both switches are open (Fig. 6).

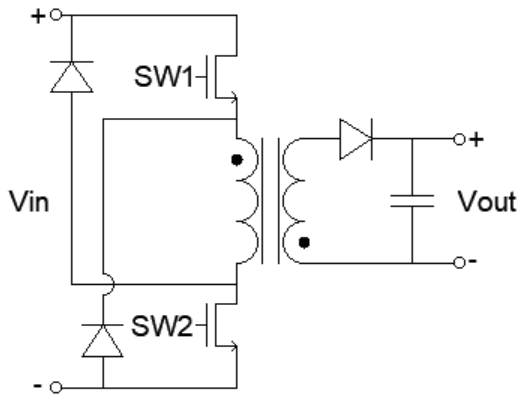

Fig. 4: Typical 2-Switch Flyback Converter Circuit DiagramTypical 2-Switch Flyback Converter Circuit Diagram

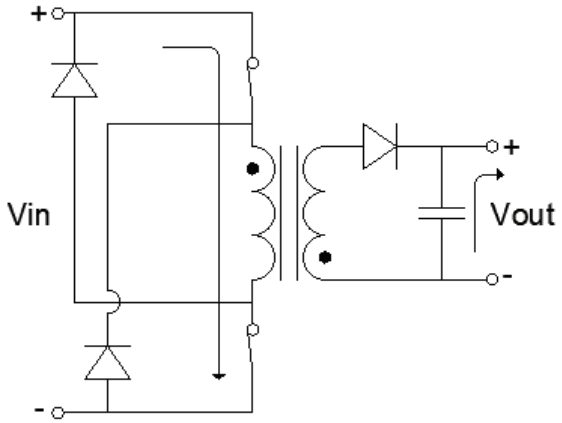

Fig. 5: Current Flow w/ Both Switches Closed-Current Flow w/ Both Switches Closed

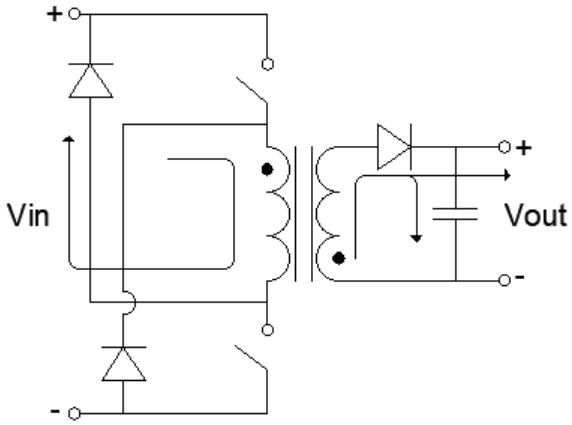

Fig. 6: Current Flow w/ Both Switches Open-Current Flow w/ Both Switches Open

FLYBACK TRANSFORMER APPLICATION NOTES

Because of flyback transformer's simplicity and versatility, they are used for many different types of applications including and not limited to:

- DC-DC power supplies
- AC-DC power supplies
- High voltage power supplies
- Battery charging
- Solar microinverters
- LED lighting
- Telecommunications

MPS's team of engineers has the knowledge and experience to design custom flyback transformers to meet the customers' specific needs. We know that low cost, efficiency and size are important to our customers, and our engineers will work closely with them to make sure the design will meet their specifications while keeping those important factors in mind.

MPS engineers have extensive experience working with customers in the medical, military, automotive and commercial fields. We know safety is an important factor and can design to meet many standards, including but not limited to UL, CSA, VDE, ICE, PPAP, MIL and IPC.

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