

Introduction

The development of Power over Ethernet (PoE) devices has resulted in devices with increased functionality, smaller size, and simplified design. This article highlights the [MP8017](#), an ultra-small, IEEE 802.3af-compatible, powered device (PD) solution with a minimal number of external components.

What is PoE?

PoE uses network cables to supply power from the power sourcing equipment (PSE) to the PD. The advantages of PoE over traditional adapter power supply methods include the following:

- Reduced cost
- Simplified installation
- Highly convenient remote control
- Improved compatibility

The simple application structure for PoE devices has made them an integral part of products we use on a daily basis (see Figure 1).

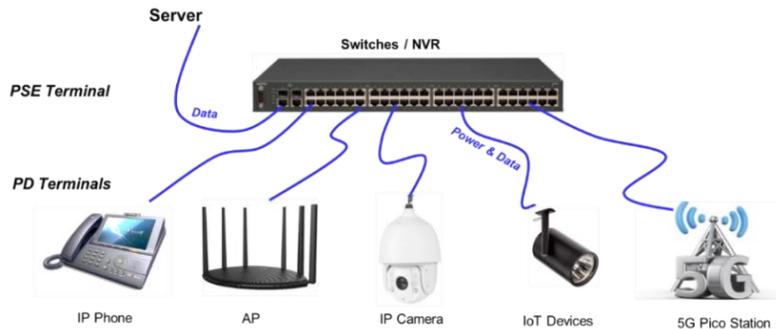


Figure 1: PoE Application Structure

Introducing the MP8017

With the extensive application of PoE power supplies, the demand for high-quality power supplies and increasingly complex equipment is rising. MPS committed to PoE application research and developed the MP8017, which significantly improves on traditional solutions. Figure 2 shows a simplified flyback circuit using the MP8017.

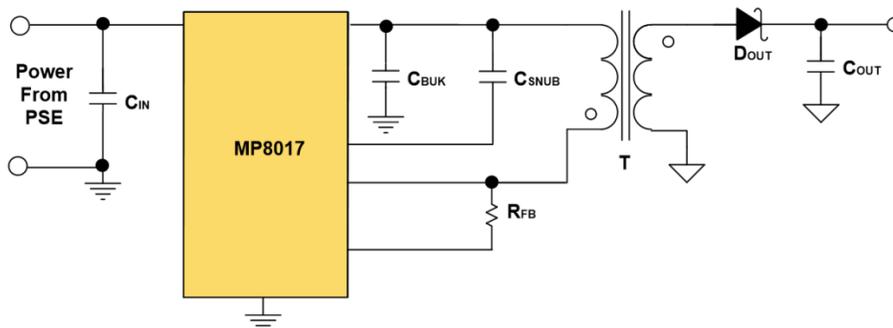


Figure 2: MP8017 PoE Flyback Circuit

Figure 3 shows how the MP8017 optimizes the six modules of the PoE flyback.

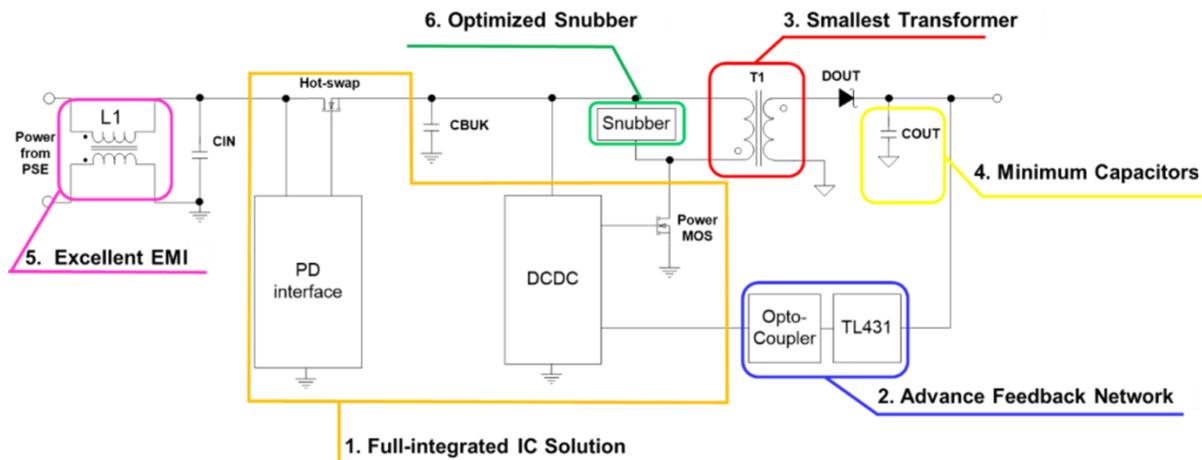


Figure 3: Block Diagram of PoE Flyback Power Supply

Fully Integrated Solution

To achieve a compact power supply solution, a fully integrated chip contains a PD, DC/DC converter, and hot-swap power MOSFET. Since there are fewer external components, this solution reduces PCB space and shortens design cycles. The MP8017 is available in a ultra-small QFN-19 (3mmx4mm) package (see Figure 4).

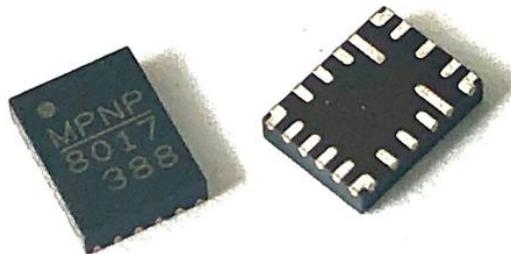


Figure 4: MP8017's QFN-19 (3mmx4mm) Package

Advanced Feedback Network

A conventional flyback often requires a TL431, optocoupler feedback network, loop compensation, and soft-start circuit. With the development of new flyback solutions, the primary feedback method emerged, which typically includes auxiliary winding.

The MP8017 utilizes an advanced feedback method that does not require auxiliary winding; instead, it directly samples the output voltage (V_{OUT}). This approach has many advantages, including the following:

- Simplified design circuits, including transformers that do not require auxiliary winding
- Reduced transformer cost
- Additional power windings that can be wound on the same core to reduce the impedance and achieve higher efficiency

Figure 5 shows the MP8017's sampling feedback mode.

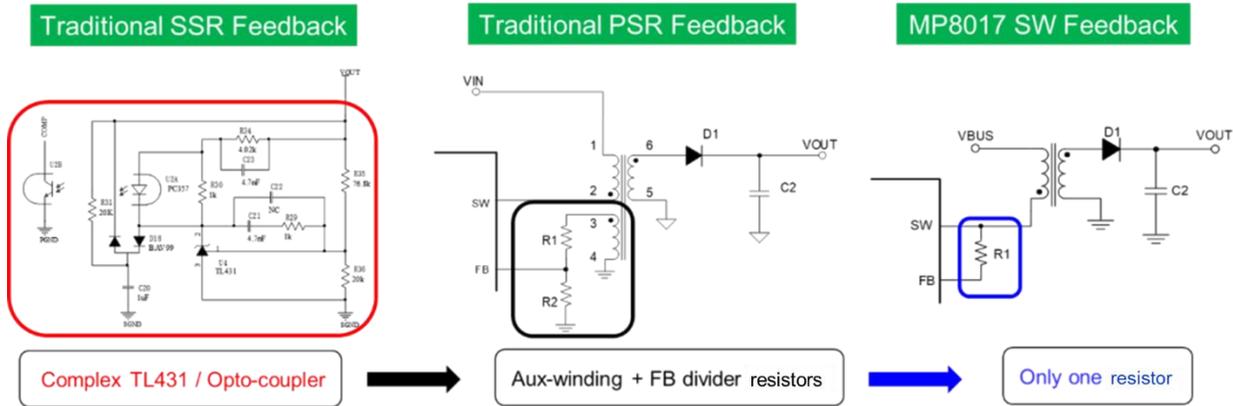


Figure 5: MP8017's Sampling Feedback Mode

Ultra-Small Transformer

Transformers are generally the most expensive and bulky device in the entire system. The 12W applications on the market today often use EP13 transformers.

In comparison, the MP8017 only requires an EP7 transformer, leading to a significant reduction in both volume and price. The MP8017 has two key design advantages that allow for a smaller and cheaper transformer:

1. Auxiliary winding is not required to reduce transformer winding
2. Up to a 650kHz switching frequency (f_{sw}) to reduce the number of transformer windings

Figure 6 shows the size difference between EP13 and EP7 transformers. The MP8017's 12W application adopts an EP7 transformer.

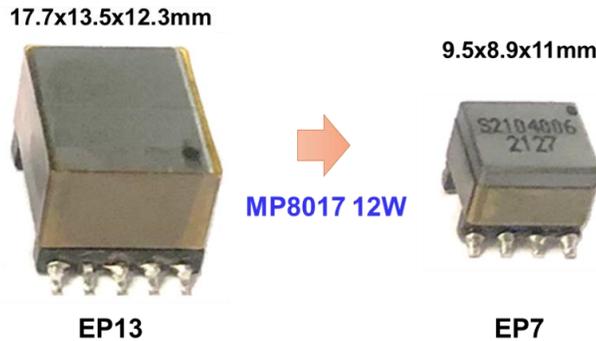


Figure 6: MP8017's 12W Applications Adopt an EP7 Transformer

Minimum Input and Output Capacitance

The frequency of general PoE devices is typically around 250kHz, which requires electrolytic capacitors to reduce ripples. The MP8017's frequency (which can reach as high as 650kHz) can greatly reduce the requirements of input and output capacitors. For 12W applications, two ceramic capacitors (0805) are sufficient. The MP8017's efficient layout reduces current peaks and the ripple caused by ESR or layout resistance.

Excellent EMI Design

Optimizing EMI poses an important challenge for PoE devices in order to pass the EMI standard. Flyback solutions generally require a common-mode (CM) inductor to improve EMI performance. However, the CM inductor is an expensive, large device.

To address these EMI performance challenges, the MP8017 offers the frequency jitter function as well as a smoother SW waveform. The MP8017's frequency jittering reduces EMI peaks (see Figure 7).

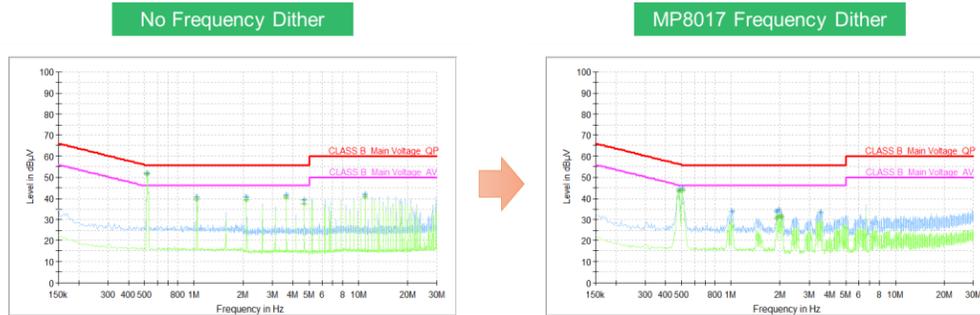


Figure 7: MP8017's Frequency Jittering Reduces EMI Peaks

Figure 8 shows how the MP8017's smooth SW waveforms attenuates EMI interference sources.

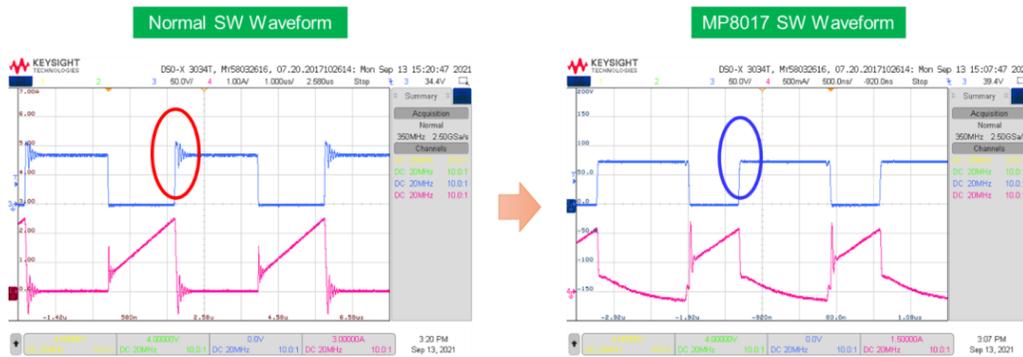


Figure 8: MP8017's Smooth SW Waveforms Attenuates EMI Sources

Optimized Snubber Clamping Circuit

In flyback applications, RCD is typically used as the clamping circuit to reduce SW's peak voltage and absorb leakage inductance energy. This circuit poses two issues:

1. SW produces resonance, which has an adverse impact on EMI.
2. After the leakage inductance energy is consumed, system efficiency is negatively impacted.

To mitigate these issues, the MP8017 adopts active-clamp control (see Figure 9).

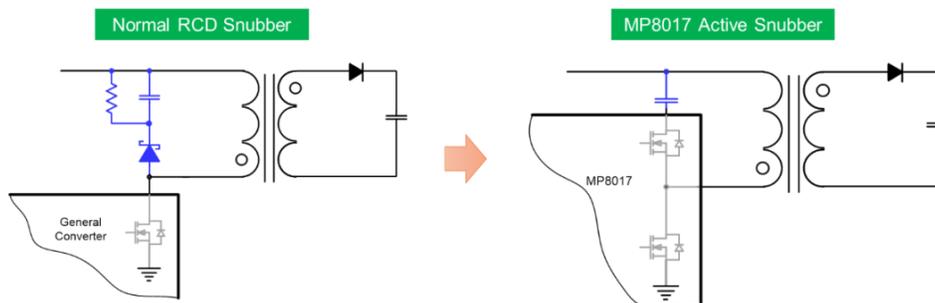


Figure 9: MP8017's Active-Clamp Circuit

Conclusion

The growing demand for PoE power supplies led to the development of the [MP8017](#). Using the MP8017, designers can effectively optimize the six large modules of the PoE flyback. With features such as high integration, reduced external component count, smaller size, and active-clamp control, this flyback converter is setting PoE trends in the industry.