

Fully Integrated Active Clamp Flyback Controller Extends Benefits To 60-W AC Adapters

[Silanna Semiconductor](#) has expanded its line of fully integrated active clamp flyback (ACF) controllers with the 60-W SZ1105 flyback PWM controller. Like the previously released 30-W SZ1101, the SZ1105 60-W controller combines four key ACF components: an advanced adaptive digital ACF controller and three ultra-high-voltage (UHV) components—an active clamp MOSFET, an active clamp FET driver and a startup voltage regulator. According to Zahid Rahim, VP of marketing at Silanna Semiconductor, the integration of these four building blocks sets apart his company's ACF controllers from others on the market, which only bring some of these functions on chip (see the figure).

This high level of integration facilitates the design of efficient, high-power-density ac-dc power adapters with a low bill-of-materials (BOM) cost. The 30-W version is suited for designing mobile phone travel adapters, while the 60-W version is suited for designing slim and compact adapters for powering notebooks, video game consoles and multi-port wall chargers.

High-power-density capabilities help designers overcome the thermal challenges of packing ever-increasing amounts of power into the small-form-factor power adapters that consumers have come to expect will also remain cool to the touch. High efficiency, or reducing power loss, is key to achieving the power density without overheating the adapter's case. With an easy-to-use simple flyback controller and an all-silicon design, the SZ1105 delivers over 93% efficiency at 20 V and 3 A, and over 20 W/in³ power density at the full 60-W output power, while using an industry-standard, avalanche-rated silicon MOSFET main switch.

The SZ1105 combines the design simplicity of a traditional flyback with the efficiency and power density of an ACF: Silanna's integrated circuit overcomes the traditional complexities of designing with ACF controllers. It eliminates the need for a tight tolerance for the clamp capacitor—the value can be off as much as ±50% says Rahim—and the leakage inductance. Instead, Silanna's proprietary OptiMode adaptive digital control technology precisely manages the critical on/off timing of the active-clamp FET based on system operating conditions.

Rahim adds that the company's digital control methods allow it to use an active clamp FET with 1/10th the conduction loss of that used in a conventional design. This downsizing of the MOSFET in turn allows it to be integrated within the controller. Additionally, the clamp capacitor is 1/100th the value of that used in a competing ACF solution, says Rahim, reducing the size and cost of the cap.

By replacing the traditional RCD snubber with a clamp capacitor and an integrated active-clamp MOSFET, the SZ1105 delivers lossless recycling of leakage energy to the output. Precise control of the active clamp circuit delivers near-zero-voltage switching (ZVS) for further efficiency improvements. Additional features include optimal valley mode switching, tight switching frequency control, and intelligent switching frequency handling, all of which result in higher efficiency, a reduced main switch voltage rating, and appreciable attenuation of common-mode EMI noise.

The SZ1105 reduces BOM cost not only by integrating the ACF circuit, but also by enabling designers to use a lower-cost transformer, SR FET, clamp capacitor and input filter.

Key specifications for ACF designs based on the SZ1105 include:

- Input: 90 to 265 Vac
- Output: 3.3 V, 5 V, 9 V, 11 V, 12 V, 15 V and 20 V
- Output current: 3 A max
- Output power: 60 W max
- Output Port: USB-PD 3.0 or PPS
- Efficiency: >93% full power efficiency with an all-silicon design.

Other key features of designs based on the controller:

- Tight switching frequency regulation for improved input EMI filter utilization
- Cycle-by-cycle adaptive digital control (OptiMode)
- Meets DoE and CoC efficiency and no-load standby power requirements.

Housed in an industry-standard 16-pin SOIC, a latched version (SZ1105-01) is available immediately for sampling, and a hiccup-mode version will be available later in Q2. Unit pricing in quantities of 10,000 pieces is still to be determined. More information and visuals are available at <https://www.silannasemi.com/press-kits>.

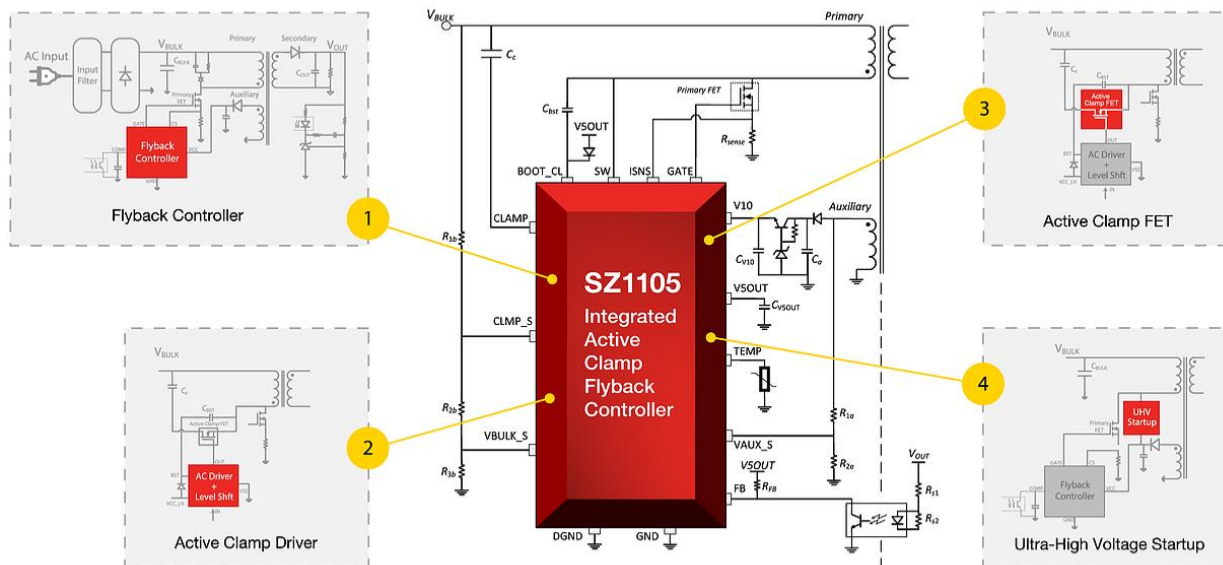


Figure. The 60-W SZ1105 all-silicon design combines the simplicity of flyback controllers with the power density enabled by active clamp flyback controllers, yielding over 93% efficiency and 20-W/in³ power density for 60-W ac-dc power adapters.