ISSUE: June 2022

Switcher ICs Extend Adapter Designs To 220 W With Small Size

Power Integrations has expanded its InnoSwitch4-CZ family of high-frequency, zero-voltage switching (ZVS) flyback controller ICs. When paired with Power Integrations' ClampZero active-clamp IC and, optionally, the recently announced HiperPFS-5 GaN-based power-factor corrector, the new ICs easily address the latest USB PD 3.1 specification for adapters and chargers up to 220 W, according to the vendor.

This expansion of the product series builds on last year's introduction of the InnoSwitch4-CZ family (see "Flyback Switcher ICs Enable Compact Mobile Chargers"). The table below highlights the new devices—both the InnoSwitch4-CZ and the ClampZero chips—and shows the higher power levels these new ICs enable on adapter and open-frame power supply designs. For applications above 75 W, the HiperPFS-5 implements a PFC stage that works well with the InnoSwitch4-CZ and Clamp Zero design (Fig. 1).

"The expanded power range of the new InnoSwitch4-CZ and ClampZero ICs allows charger/adapter designers to easily exceed 23 W per cubic inch for single- and multiple-output USB PD 3.1 certified designs," explained Edward Ong, senior product marketing manager at Power Integrations.

"Even at 220 W of output power, the family's high efficiency minimizes waste heat; bulky heatsinks are not required on any of the active devices. The maximum switching frequency of up to 140 kHz minimizes transformer size, and the high level of integration approximately halves the number of passive components, MOSFETs and diodes that make safety-compliant PCB layout a challenge."

According to Andy Smith, when compared with some of the other switcher IC families that Power Integrations offers, such as InnoSwitch3 and InnoSwitch3-PD, InnoSwitch4-CZ is further optimized to minimize power supply size. Its higher switching frequency reflects this focus (Fig. 2).

InnoSwitch4-CZ ICs include a robust 750-V PowiGaN primary switch, active clamp drive and synchronous rectification in a compact InSOP-24D package. Secondary-side sensing—achieved using Power Integrations' FluxLink high-speed communications technology— provides exceptional CV/CC accuracy.

Adds Ong, "The use of a non-complementary-mode active clamp enables designs that work in both continuous (CCM) and discontinuous (DCM) modes. By operating across modes, it is much easier to support the wide load/range conditions often encountered in USB PD applications." See Fig. 3.

InnoSwitch4-CZ ICs consume less than 30 mW at no-load, including input line voltage monitoring. The ICs feature a comprehensive suite of protection features, including auto-restart or latching fault response for output over- and under-voltage; multiple output under-voltage fault thresholds; and latching or hysteretic primary over-temperature protection.

A highly compact 130-W, USB PD adaptor reference design (DER-957, pictured in Figs. 1 and 2) is available for designers wishing to evaluate the InnoSwitch4-CZ flyback controller IC and ClampZero active clamp IC chipset. Devices are priced starting at $3.07 for INN4072C-TL and $0.66 for CPZ1061M-TLXXX in 1,000-unit quantities of the chipset. For further information, contact a Power Integrations sales representative or one of the company's authorized worldwide distributors: Digi-Key, Farnell, Mouser and RS Components, or visit the InnoSwitch4-CZ page.

Table. New InnoSwitch4-CZ and ClampZero ICs expand the power range for adapter designs to meet USB PD 3.1 requirements. The Extended Power Range of the USB-PD standard allows for power delivery up to 240 W.

Part Number		85-264 VAC		230 VAC ±15%		385 VDC (PFC input)	
InnoSwitch4-CZ	ClampZero	Adapter	Open Frame	Adapter	Open Frame	Adapter	Open Frame
INN4072C	CPZ1061M	42 W	50 W	50 W	55 W		
INN4073C		60 W	70 W	70 W	75 W		
INN4074C	CPZ1062M	75 W	85 W	85 W	90 W		
INN4075C		80 W	90 W	90 W	100 W		
INN4076C	CPZ1075M	100 W	115 W	115 W	125 W		
INN4077C		115 W	135 W	135 W	145 W		
INN4174C	CPZ1076M					155 W	170 W
INN4175C						160 W	180 W
INN4176C						180 W	200 W
INN4177C						200 W	220 W

New parts:

Typical maximum power output
Increased cooling increases output power

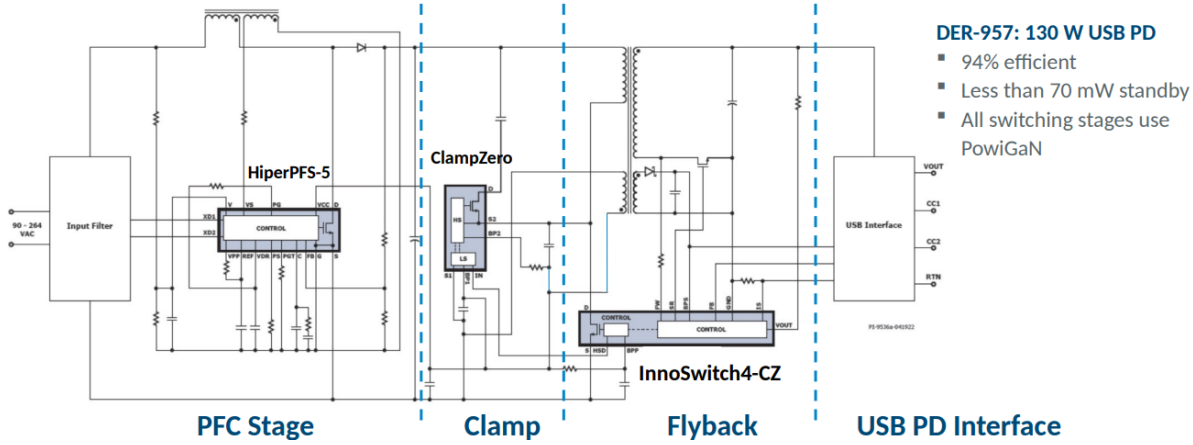


Fig. 1. For applications above 75 W, which require power factor correction, the InnoSwitch4-CZ chipset operates seamlessly with the HiperPFS-5 PFC, delivering excellent PF, high efficiency and low parts count. New high-voltage GaN switches boost efficiency to 95%, yielding ultra-compact USB PD 3.1 adapters, according to the vendor.

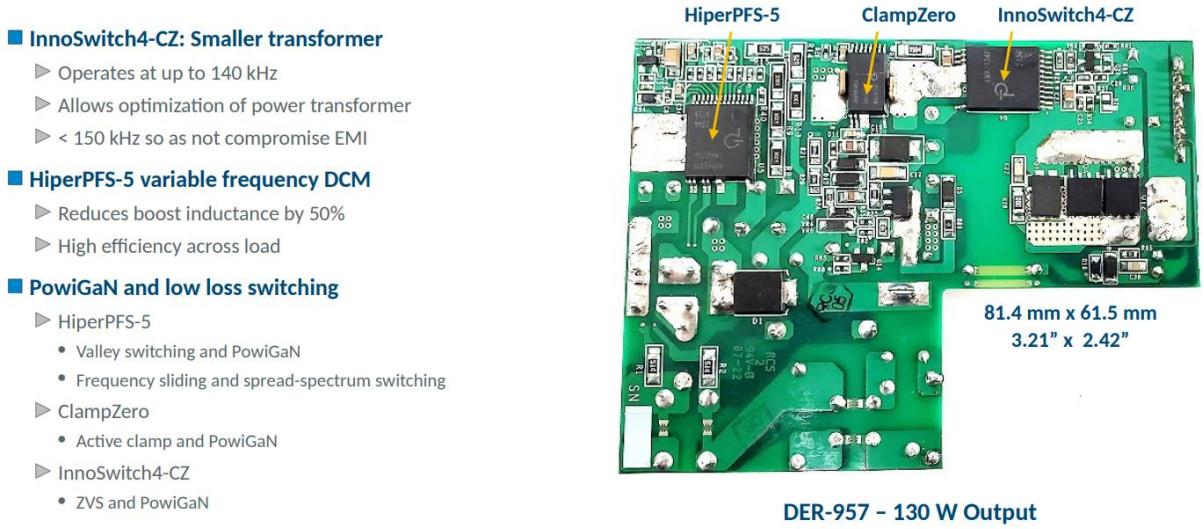
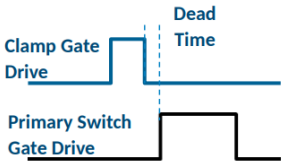


Fig. 2. This 130-W reference design illustrates the small magnetics and high efficiency that are made possible by InnoSwitch4-CZ and ClampZero ICs.

- **Ideal for rapid-charge applications**
  - Widely changing output voltage and load
    - Important with move to 3.3 V - 48 V output power
    - 0 W – 240 W
    - Wide range input
  - Seamless DCM - CCM transition
    - Operation supports wide output power
    - Conventional active clamp circuits cannot do this



**Non-Complementary Mode Switching –
Active Clamp is Cycled Just Before Primary Switch**

- **CCM/DCM supports increasing O/P range – acts like a gear shift**
  - Avoids the burst-mode and output filtering needed for circuits using conventional clamp circuits

Fig. 3. While the traditional approach to active clamp operation employs two switches operating in anti-phase (one on and one off), Power Integrations implements active clamp in a non-complementary mode, turning on the clamp briefly before turn-on of the main switch. This allows the switcher to be run in both DCM and CCM modes (with the benefits of avoiding burst mode operation and reducing output filtering), whereas others implementing complementary mode switching can only run in DCM. According to PI, non-complementary active clamping ensures the most cost-effective use of clamp energy.