HOW2POWER TODAY
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# *Power Supply ICs Extend Flyback Power Output To 440 W*

Power Integrations' TOPSwitchGaN flyback IC family extends the power range of flyback converters to 440 W—well beyond the limits that traditionally required more complex resonant and LLC topologies. The TOPSwitchGaN flyback ICs unite the company's PowiGaN power switches with its TOPSwitch IC architecture, reducing complexity, eliminating heat sinks in many cases, shortening design time, improving manufacturability, and lowering total system cost (Fig. 1).

"This is more than a product evolution—it's a fundamental shift in how engineers can approach power supply design," said Silvestro Fimiani, director of product marketing at Power Integrations. "For decades, designers have had to move to resonant topologies like LLC as power levels increased. With TOPSwitchGaN, we're pushing flyback into a power range previously not possible, allowing engineers to achieve high efficiency and performance with a far simpler architecture." See Figs. 2 and 3.

According to Andy Smith, director of training and technical outreach at Power Integrations, the existing TopSwitch family, which was launched in 1994, enables flyback designs with up to 250 W output. That limit is set by the $I^2R$ loss imposed by the silicon power MOSFET used as the primary switch. The introduction of the PowiGaN power switch (a depletion-mode GaN transistor) in TOPSwitchGaN extends this upper bound to approximately 440 W.

TOPSwitchGaN ICs provide 92% efficiency across the load range—from 10% percent to full load—and are said to easily beat European Energy-related Products (ErP) regulations at less than 50-mW power consumption for standby and off modes. The device does this without the need for synchronous rectification.

PowiGaN switches deliver much lower $R_{DS(ON)}$ than silicon. This results in reduced conduction losses which dramatically increase the power capability of flyback converters. These new devices incorporate 800-V PowiGaN switches, which provide excellent surge-withstand capabilities and low switching losses, meaning that they can operate at switching frequencies of up to 150 kHz to minimize transformer size.

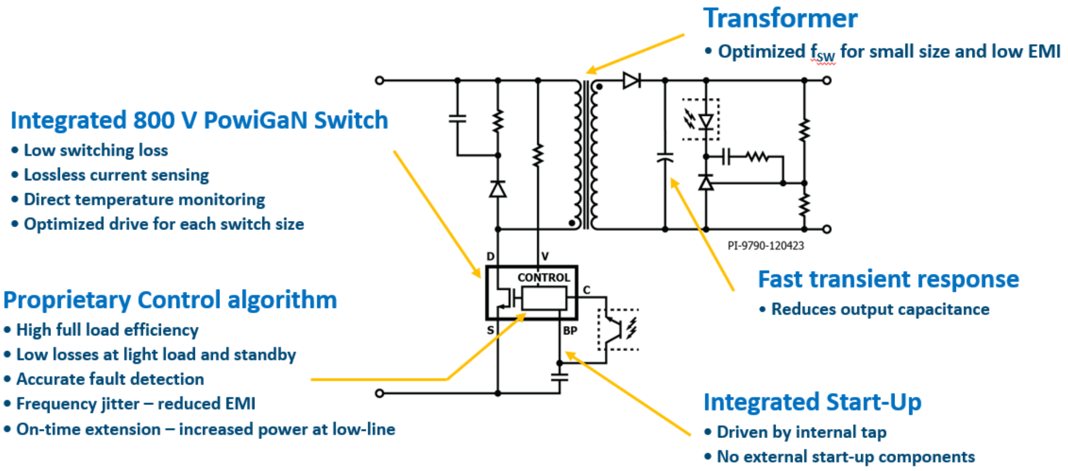
No-load consumption is well below 50 mW at 230 Vac including line sense, and up to 210 mW of output power is available for 300 mW input at 230 Vac to run housekeeping functions when units are in standby mode.

The new ICs are available in two styles. For ultra-slim designs, low-profile eSOP-12 surface-mount packaging enables 135 W (85 to 265 Vac) to be delivered without a heat sink for applications such as appliances. The vertical orientation of the eSIP-7 package minimizes PCB footprint and has a thermal impedance equivalent to a TO-220-packaged part.

By mounting a metal heat sink using a simple clip, the extended power range is achieved for applications including power tools, e-bikes, and garage openers. Because TOPSwitchGaN ICs are pin-to-pin compatible with TinySwitch-5 offline switcher ICs, designers can use the same methodology for applications spanning 10 W up to 440 W (see the table and Fig. 1 again.)

A few reference designs are offered for TOPSwitchGaN. These include the DER-1079, which uses the TOP7074K to deliver a 60-W, wide-range isolated flyback PSU for appliances; the DER-1019, which details a 356-W highline (89 V/4 A) isolated flyback industrial PSU, based on the TOP7078E; and the RDK-1018, an e-bike charger kit that is a 168-W wide-range isolated flyback design using the TOP7075E.

For more information on the TOPSwitchGaN family, see the product page. For more on the three reference designs, see the DER-1079, DER-1019, and RDK-1018 pages. Pricing for TOPSwitchGaN starts at $1.00 each for 10,000-unit quantities (TOP7074K-TL). For further information, contact a Power Integrations sales representative or one of the company's authorized worldwide distributors—DigiKey, Newark, Mouser and RS Components.



**Transformer**

- Optimized $f_{SW}$ for small size and low EMI

**Integrated 800 V PowiGaN Switch**

- Low switching loss
- Lossless current sensing
- Direct temperature monitoring
- Optimized drive for each switch size

**Proprietary Control algorithm**

- High full load efficiency
- Low losses at light load and standby
- Accurate fault detection
- Frequency jitter – reduced EMI
- On-time extension – increased power at low-line

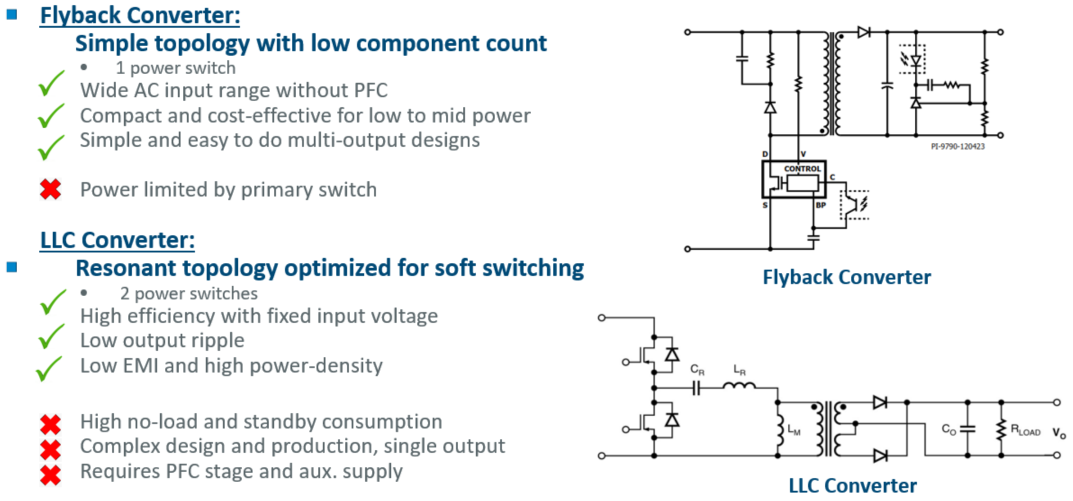
**Fast transient response**

- Reduces output capacitance

**Integrated Start-Up**

- Driven by internal tap
- No external start-up components

*Fig. 1. Simplified application schematic for TopSwitchGaN with notes on features. TopSwitchGaN employs the same control and circuitry as TinySwitch-5, enabling customers to develop solutions spanning 10 W to 440 W.*



- **Flyback Converter:**
  **Simple topology with low component count**
  - 1 power switch
  - ✓ Wide AC input range without PFC
  - ✓ Compact and cost-effective for low to mid power
  - ✓ Simple and easy to do multi-output designs
  - ✗ Power limited by primary switch

- **LLC Converter:**
  **Resonant topology optimized for soft switching**
  - 2 power switches
  - ✓ High efficiency with fixed input voltage
  - ✓ Low output ripple
  - ✓ Low EMI and high power-density
  - ✗ High no-load and standby consumption
  - ✗ Complex design and production, single output
  - ✗ Requires PFC stage and aux. supply

**Flyback Converter**

**LLC Converter**

*Fig. 2. Comparing a flyback implemeted with the TopSwitchGaN IC versus a resonant LLC.*

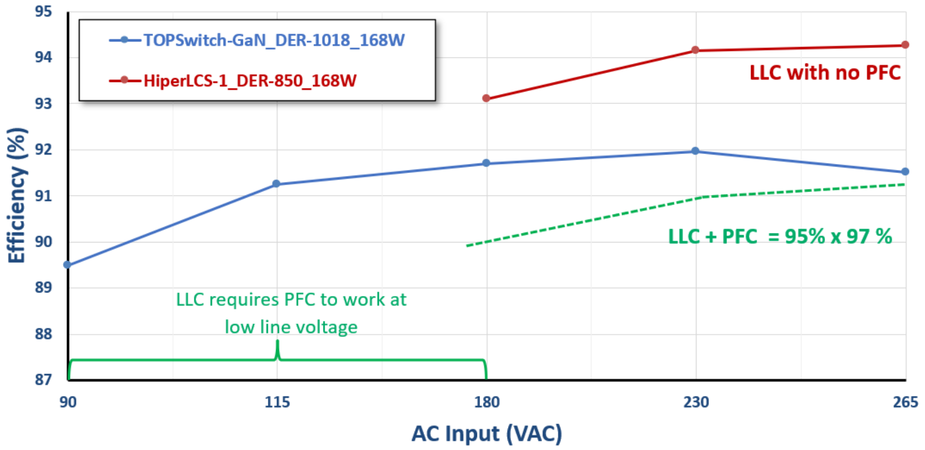
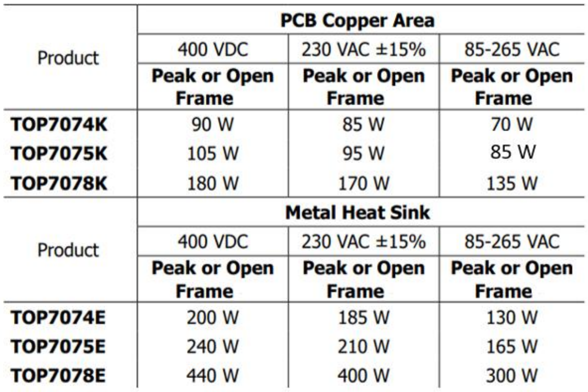


*Fig. 3. Comparing the efficiency of a flyback design using TopSwitchGaN IC versus a resonant LLC. Both designs are based on the Power Integrations reference designs indicated. When PFC is included in the LLC design—a requirement at low line—TopSwitchGaN outperforms it.*

Table. As with Power Integrations’ other product familes, the power output ratings for TopSwitchGaN models vary with package type, input voltage range and use of heatsinking.



| Product | PCB Copper Area | | |
|---|---|---|---|
| | 400 VDC | 230 VAC ±15% | 85-265 VAC |
| | **Peak or Open Frame** | **Peak or Open Frame** | **Peak or Open Frame** |
| **TOP7074K** | 90 W | 85 W | 70 W |
| **TOP7075K** | 105 W | 95 W | 85 W |
| **TOP7078K** | 180 W | 170 W | 135 W |
| **Product** | **Metal Heat Sink** | | |
| | 400 VDC | 230 VAC ±15% | 85-265 VAC |
| | **Peak or Open Frame** | **Peak or Open Frame** | **Peak or Open Frame** |
| **TOP7074E** | 200 W | 185 W | 130 W |
| **TOP7075E** | 240 W | 210 W | 165 W |
| **TOP7078E** | 440 W | 400 W | 300 W |

**eSOP™-12 Package (K Suffix)**
- Low profile surface mount package ultra-slim designs
- Supports wave or reflow soldering
- PCB cooling via SOURCE pin and exposed pad for low EMI

**eSIP™-7 Package (E Suffix)**
- Vertical orientation for minimum PCB footprint
- Simple heat sink mounting using clip
- Thermal impedance equivalent to TO-220 package
- Provides extended power range