

ISSUE: [July 2021](#)

## ***Offline Switcher ICs Incorporate Lossless Zero-Cross Detection And X-Capacitor Discharge***

[Power Integrations'](#) LinkSwitch-TNZ is a new family of switching power supply ICs that combine offline power conversion, lossless zero-cross detection and, optionally, X-capacitor discharge functions in a compact SO-8C package. The highly efficient LinkSwitch-TNZ ICs can be used for nonisolated buck and buck-boost power supplies up to 575 mA output current and provides up to 12 W output for universal-input isolated flyback designs (Fig. 1).

Adnaan Lokhandwala, product marketing manager at Power Integrations said, "The new LinkSwitch-TNZ ICs provide an accurate signal indicating that the sinusoidal ac line is at zero volts. This signal is used by smart home and building automation (HBA) products and appliances to control the switching of relays, IGBTs and TRIACs to minimize switching stress and system in-rush current. LinkSwitch-TNZ's detection of the zero-cross point consumes less than 5 mW, allowing systems to reduce standby power losses versus alternative approaches that require ten or more discrete components and burn 50 to 100 mW of continuous power."

Devices such as light switches, dimmers, sensors, and plugs connect and disconnect the ac line periodically using a relay or TRIAC. A discrete circuit is typically implemented to detect the ac line zero-crossing to control the turn-on transition of the main power device while reducing switching losses and inrush current. This approach requires many components and is very lossy, consuming almost half of the standby power budget in some cases.

Similarly, appliances often use a discrete zero-cross detection circuit to control motor and MCU timing. These applications also require an auxiliary power supply for functions such as wireless connectivity, gate drivers, sensors and displays.

Power Integrations has previously offered the capacitor discharge circuit as a standalone function in its Cap Zero ICs. So the LinkSwitch-TNZ marks the first time they have integrated this function into their switcher ICs. Meanwhile, the zero-cross detection function is one that they have not offered previously in any form, says Lokhandwala.

According to the vendor, LinkSwitch-TNZ ICs provide best-in-class light-load efficiencies, enabling more system features to be powered while meeting stringent standby regulations such as the European Commission (EC) standard for home appliances (1275), which requires equipment to consume no more than 0.5 W in standby or in off-mode; ENERGY STAR's version 1.1 for Smart Home Energy Management Systems (SHEMS), which limits standby consumption of smart lighting control devices to 0.5 W; and China's GB24849, which limits the off-mode power consumption in microwave ovens to 0.5 W.

LinkSwitch-TNZ ICs are also said to reduce component count by 40% or more when compared to discrete designs. Optionally, an X-capacitor discharge function can also be included in the package for high-power applications, leading to greater PCB space reduction, low BOM count and increased reliability (LNK331x). Fig. 2 provides a summary of LINKSwitch-TNZ benefits.

These switching power supply ICs enable  $\pm 3\%$  regulation across line and load, no-load consumption of less than 30 mW with external bias and have an IC standby current of less than 100  $\mu$ A. Parts are simple to design in, feature an integrated soft start, and work with both isolated and nonisolated topologies.

Four reference design examples are available for download. DER-874 and RDR-866 are non-isolated buck designs delivering 6-V, 80-mA output and 5-V, 500-mA output, respectively. RDR-877 describes a 12-V, 0.5-A output isolated flyback with secondary-side ZCD signal, while DER-879 describes a 12-V, 0.75-A and 5-V, 0.2-A isolated flyback with ZCD and integrated X-capacitor discharge circuitry.

LinkSwitch-TNZ switching power supply ICs are priced at \$ 0.84 in volume for 1000 units. 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](#). For more information, see the LinkSwitch-TNZ [page](#) and the [DER-874](#), [RDR-877](#) and [DER-879](#) pages.

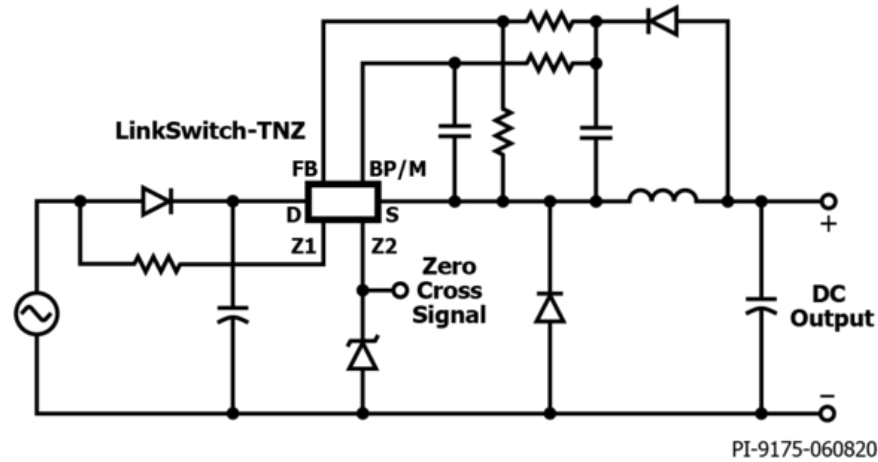


Fig. 1. The highly efficient LinkSwitch-TNZ ICs implement nonisolated buck and buck-boost power supplies up to 575 mA output current and provide up to 12 W output for universal-input isolated flyback designs. These ICs integrate a zero-cross detection circuit, which can be used to control the switching of relays, IGBTs and TRIACs, and optionally an X-capacitor discharge circuit, which eliminates the losses associated with use of bleeder resistors.

- **Performs ZVD and discharge using <20 mW in standby**
  - ▶ Discrete zero-cross detection alone is up to 100 mW
  - ▶ Excellent light-load efficiency allows more standby functions
  - ▶ Eliminates X-capacitor bleeder\* resistor losses
- **Lowest leakage prevents lamp flicker in wall controls**
- **Zero-voltage switching for relays and TRIACs reduces inrush current in hot switching applications**
  - ▶ Increased lifetime for relay used in wall switches and sensors
  - ▶ Provides ZC signal for leading/trailing-edge dimming
- **Lowest component count**
  - ▶ >40% reduction compared to discrete zero-cross detectors

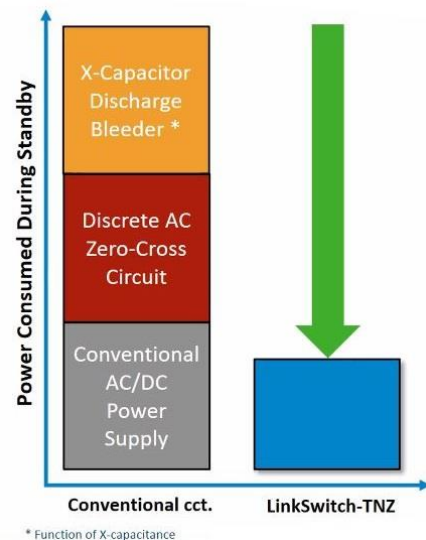


Fig. 2. The LinkSwitch-TNZ ICs provide both savings in power consumption and board space when compared to previous power supply solutions requiring zero-cross detection and X-capacitor discharge.