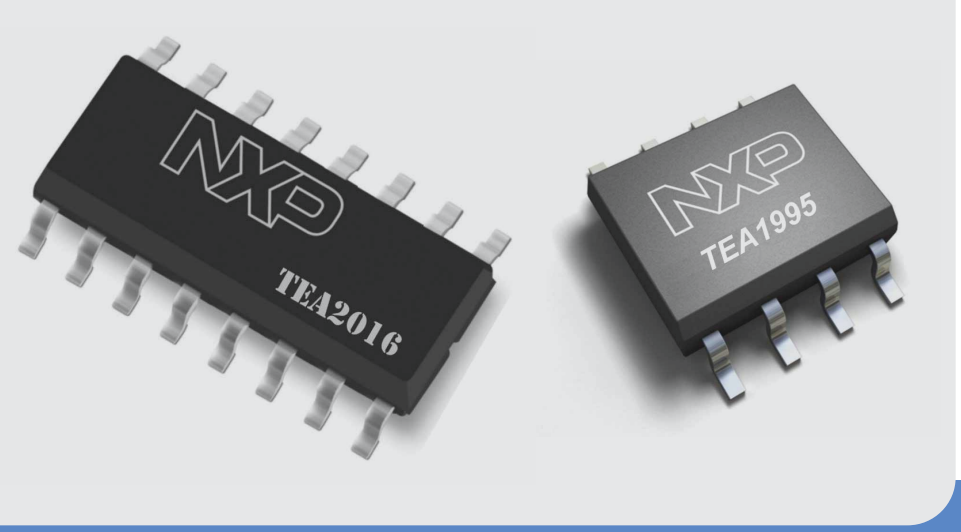


Help enable high efficiency at all load levels

NXP TEA2016 and TEA1995 ICs

NXP's latest fully digital LLC platform of TEA2016 and TEA1995 ICs provides a reliable power supply design with high efficiency and very low no-load power.

KEY FEATURES

TEA2016 DCM PFC + LLC resonant controller

- Complete functionality of LLC and PFC controller in single small-size SO16 package
- Integrated high-voltage start-up
- Integrated drivers and high-voltage level shifter (LS)
- High-side driver directly supplied from the low-side driver output (patent number 82059363US01)
- Accurate boost voltage regulation
- Integrated X-capacitor discharge without additional external components
- Power good function
- Extensive MTP programmability to optimize performance
  - Many burst mode settings to ensure lowest audible noise, highest efficiency and lowest output ripple
  - Flexible configuration of protection functions, for instance a programmable number of restarts before a latched protection occurs
  - Simple design optimization in a live application by means of setting parameters via a GUI helps users meet requirements during development
- TEA1995 dual LLC resonant SR controller
- Adaptive gate drive

TEA1995 dual LLC resonant SR controller

- No-load supply current < 200 µA
- Wide supply voltage range (4.5 to 40 V)
- Switching frequency up to 500 kHz
- No minimum on-time
- No reverse current
- Adaptive gate drive for fast turn-off at end of conduction
- SO8 package

APPLICATIONS

- Desktop and all-in-one (AIO) PCs
- Gaming consoles
- TV power supplies (Ultra-HD, 4K)
- Notebook adapters
- Lighting applications up to 350 W

The highly efficient TEA2016/TEA1995 IC combination offers a user-friendly design and reliable power supply. It provides 90 W-500 W with a minimum of external components. The system also provides very low no-load input power (< 75 mW for the total system including the TEA2016/TEA1995 combination) and operates at high efficiency from minimum to maximum load.

This new platform builds on a familiar format: the TEA1916 LLC resonant topology. It also uses synchronous rectifier (SR) control with adaptive gate drive, without minimum on-time and without reverse current, so the overall system guarantees increased efficiency over the entire load range. The new LLC platform also delivers excellent performance at low standby power, even without an auxiliary power supply, so it complies with new regulations while also reducing system cost.

Two features from our previous TEA1916 series continue to advance the new LLC platform over previous topologies: variable operating modes and cycle-by-cycle capacitive voltage (V_{CAP}) control.

VARIABLE MODES

Three operating modes—burst, low power, and high power—make it possible to automatically select the best mode for each combination of power and control voltage, resulting in higher efficiency. The burst and low-power modes operate at lower loads and use switching frequencies that are outside the audible spectrum, thus generating less acoustic noise.

CYCLE-BY-CYCLE CONTROL

The traditional approach to frequency control can be difficult to manage, since it involves high gain in the control loop, meaning even small deviations in the frequency can produce much higher output power. To make things simpler, the new NXP LLC platform keeps using a cycle-by-cycle architecture that regulates the output voltage (V_{OUT}) using the capacitance voltage (V_{Cr}) of the LLC resonant tank. The main advantage of this approach is that V_{Cr} is linear related to output power.

The cycle-by-cycle architecture enables the low-power mode, which can also be seen as a high-frequency burst mode. This mode is active between the burst and high-power modes. The cycle-by-cycle architecture also increases the efficiency of burst mode, and makes it possible to activate the burst and low-power modes at a specified output power.

The TEA2016 and TEA1995 power supply controllers are NXP GreenChip® solutions that put the new LLC platform to use.

TEA2016 PFC + RESONANT CONTROLLER

The TEA2016 is a digital configurable LLC and PFC combo controller for high-efficiency resonant power supplies. It includes both the LLC controller functionality and PFC controller operating in DCM and QR mode. The TEA2016 helps ease the design process and helps enable designers to build a complete resonant power supply with very low component count.

The TEA2016 digital architecture is based on a high-speed configurable hardware state machine ensuring reliable real-time performance. During power supply development, many operation and protection settings of the LLC and PFC controller can be adjusted by loading new settings into the device to meet specific application requirements. The extensive number of IC parameters can be programmed via a user-friendly GUI in a live operating power supply.

The TEA2016 contains protections such as overtemperature protection (OTP), overcurrent protection (OCP), overvoltage protection (OVP), overpower protection (OPP), open-loop protection (OLP), and capacitive mode regulation (CMR). Each of these protections can be configured independently and accurately by programming parameters inside the device.

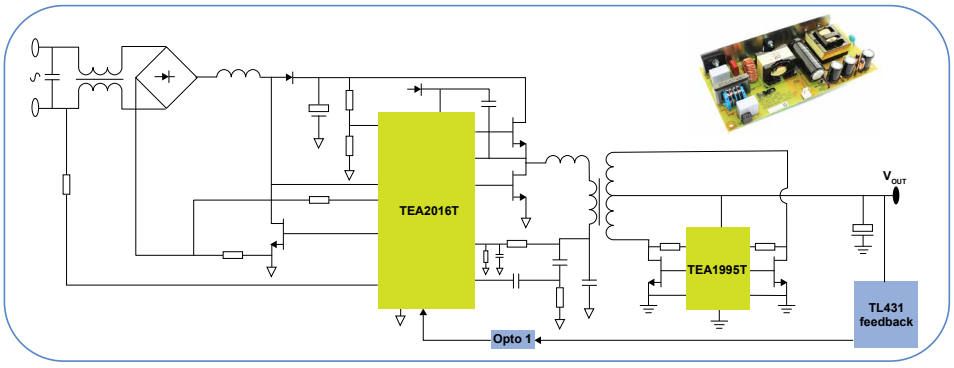
TEA1995 DUAL SR CONTROLLER

The TEA1995 is a dual SR controller optimized for resonant (LLC) power supplies. Housed in an SO8 package, the TEA1995 supports 5 V operation with logic-level SR MOSFETs. Adaptive gate control at low and high loads produces high efficiency over the entire load range. The TEA1995 can be used with a wide range of supply voltages, for operation from 4.5 to 40 V. The TEA1995 supports switching frequencies up to 500 kHz.

NXP GREENCHIP SOLUTIONS

The NXP GreenChip power solutions portfolio enables smarter, more compact energy-efficient power solutions. Complete GreenChip system solutions help optimize applications such as highly efficient power supplies and system protection.

PFC+LLC+SR APPLICATION DIAGRAM



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