

GreenChip digital LLC platform TEA1916 / TEA1995

Simplifying the design of high-efficiency resonant power supplies

NXP's TEA1916 and TEA1995 GreenChip IC combination helps you significantly to reduce the design complexity of high-efficiency resonant power supplies while meeting ever tougher regulations. Offering a high level of digital integration and control, this new LLC platform delivers a significant advance over previous topologies resulting in high efficiency over the complete load range.

Key features

- TEA1916 DCM PFC + LLC resonant controller
 - Multi-mode operation for superior efficiency at lower loads
 - Excellent no-load (standby) power
 - Meets EuP Lot 6 requirements with significant margin
 - No need for auxiliary (standby) power supply
 - Capacitive Mode Protection, OCP, OPP and many other protections
 - Integrated high-voltage startup, drivers and level shifter
- TEA1995 dual LLC resonant SR controller
 - Adaptive gate drive for maximum efficiency at any load
 - Supply current in energy save operation mode below 200 μ A
 - Wide supply voltage range (4.5 to 38 V)
 - Switching frequency up to 500 kHz
 - No minimum on-time or reverse current for optimized efficiency and enabling high frequency
 - Adaptive gate drive for fast turn-off at end of conduction

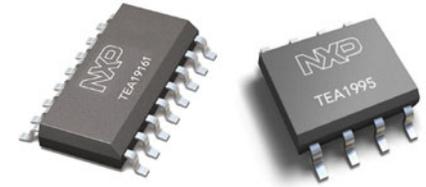
Key applications

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

The TEA1916 and TEA1995 provide integrated digital control for easy and robust design of high efficiency resonant power supplies with excellent no-load power. The solution maximizes light-load efficiency without adding cost for additional switching circuitry. The result is a cost-effective design that meets current and upcoming regulations (Energy Star v6, CoC tier 2, 80+ Platinum) and government guidelines including US Department of Energy (DoE) and the European Union's Ecodesign Directive.

Our digital platform combines an LLC resonant topology with synchronous rectifier (SR) control with adaptive gate drive. Compared to a flyback topology, the LLC resonant topology makes it easier to meet requirements for Common Mode noise and 200 percent peak power.

The overall system guarantees increased efficiency over the entire load range due to NXP's patented Cycle-by-Cycle / V_{CAP} control. It also delivers excellent performance at low standby power so it complies with new regulations while also reducing system cost. Two features in particular make the new LLC platform superior to 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 – allow automatic selection of the best mode for each combination of power and control voltage, resulting in higher efficiency. To ensure less acoustic noise, burst and low-power modes operate at lower loads and use switching frequencies that are outside the audible spectrum.

Cycle-by-cycle control

The platform simplifies frequency control, eliminating the high gain sensitivity of traditional frequency control methods. It uses a cycle-by-cycle architecture that regulates the output voltage (V_{OUT}) using the capacitance voltage (V_{Cf}) of the LLC resonant tank. The architecture enables the low-power mode, which can be seen as a high-frequency burst mode, active between burst and high-power modes. The architecture increases burst mode efficiency, and allows burst and low-power modes to be activated at a specified output power.

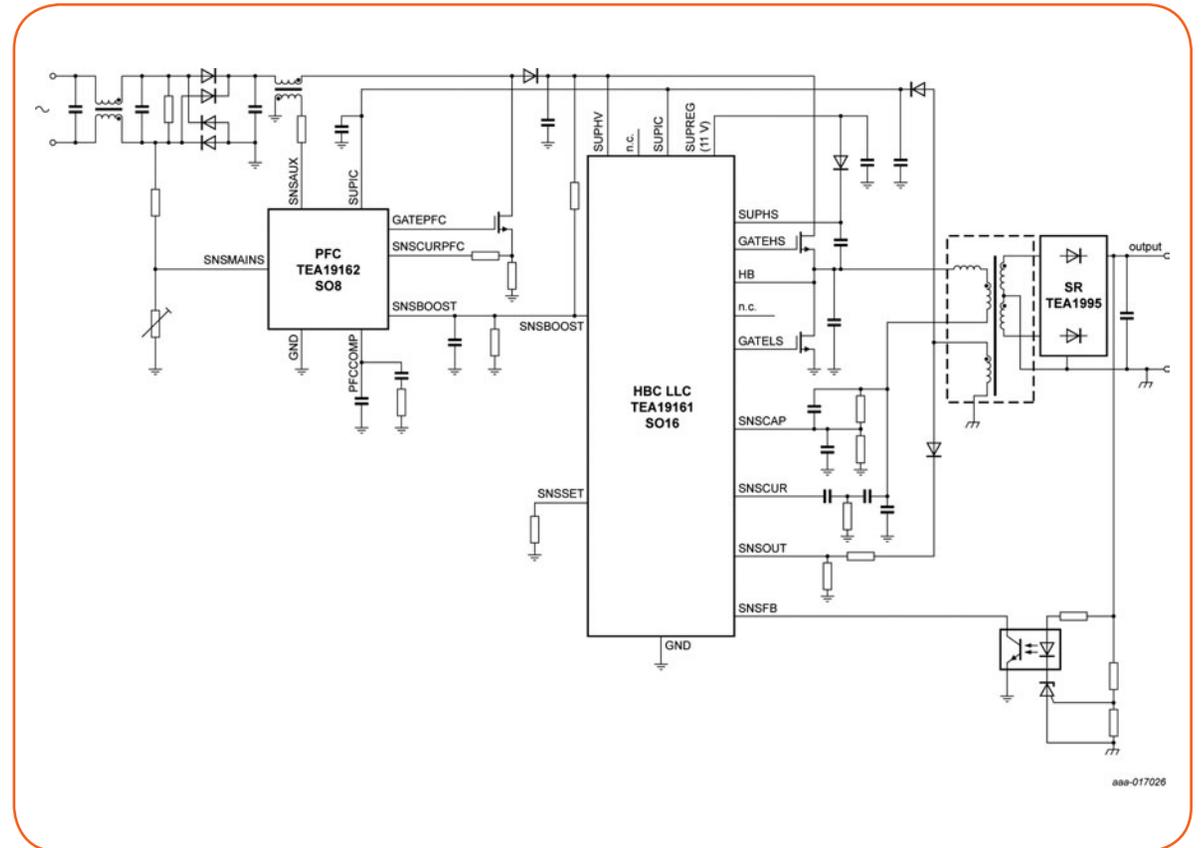
TEA1916 PFC + resonant controller

As a two-package solution, the TEA1916 places the PFC function in an SO8 package and the HB LLC function in an SO16 package. This enables a highly cost-optimized application and smaller and more flexible PCB design. Implementation is made easier by using cycle-by-cycle V_{CAP} control, which has a linear relation to the output power. Featuring very high efficiency at light load (10 to 30 percent load), the TEA1916 will comply with next generation energy efficiency regulations. It also features low no-load power below 75 mW, and meets EuP lot6.

TEA1995 dual sr controller

The TEA1995 is a dual SR controller optimized for LLC resonant power supplies. Housed in an SO8 package, it 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, operating from 4.5 to 38 V, and supports switching frequencies up to 500 kHz.

PFC+LLC+SyncRec Application Diagram



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