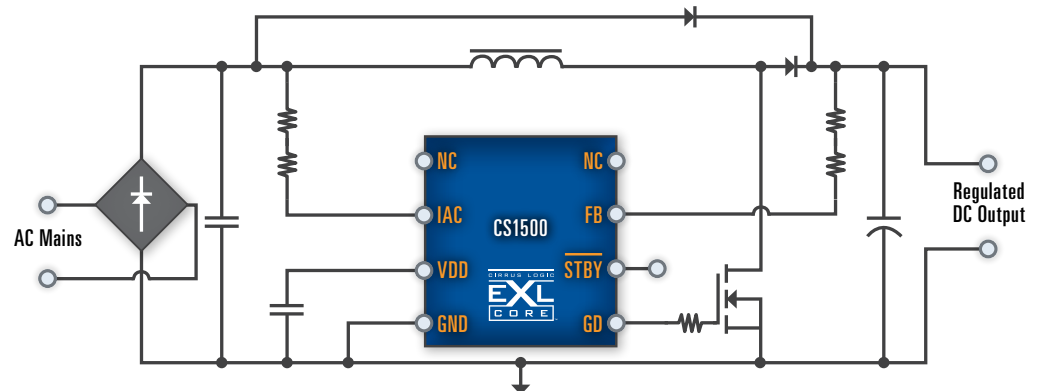


# CS1500 Digital PFC Controller

## ULTRA HIGH EFFICIENCY POWER FACTOR CORRECTION IC



**CS1500 8-PIN SOIC**

(actual size: 5 mm x 5 mm)



**DIGITAL TELEVISIONS**



**NOTEBOOK ADAPTERS**



**PC POWER SUPPLIES**

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### OVERVIEW

The CS1500 is a high-performance Variable Frequency Discontinuous Mode, active digital power factor correction (PFC) controller. It features Cirrus Logic's EXL Core™ technology that brings digital energy control innovation which elevates performance and solves system design challenges in power supplies used in notebook adapters, digital TVs and PCs.

The unique digital architecture of the CS1500 enables reduced-size EMI filters and eliminates the need for numerous passive components, delivering the lowest PFC system costs available.

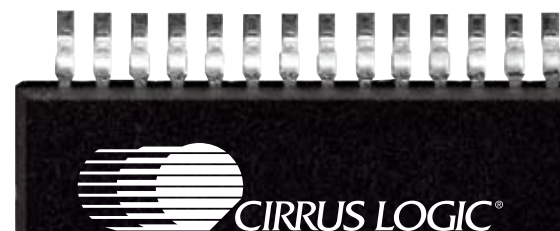
Variable on-time / variable frequency algorithm is used to achieve close to unity power factor and shaping the EMI noise spectrum, thus reducing the conducted EMI filtering size and cost. The feedback loop is closed through an integrated compensation network within the IC, eliminating the need for additional external components. Protection features (such as overvoltage, overpower, open and short circuit protection, over-temperature, and brownout) help protect the device during abnormal transient conditions.

### FEATURES

- Ultra High Efficiency
- Digital EMI Noise Shaping
- Digital Over-Current Protection
- Variable Frequency DCM for Light Load Efficiency
- Comprehensive On-Chip Protection

### EXL CORE TECHNOLOGY

The EXL Core is a digital technology platform at the heart of Cirrus Logic's commitment to develop innovative solutions that help our customers cost effectively create smarter, greener energy products



CS1500 uses a proprietary digital control algorithm to shape conducted EMI emissions, resulting in significantly reduced EMI filter requirements.

Digital EMI Noise Shaping consists of three major components:

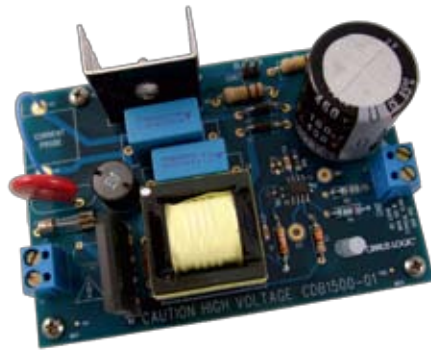
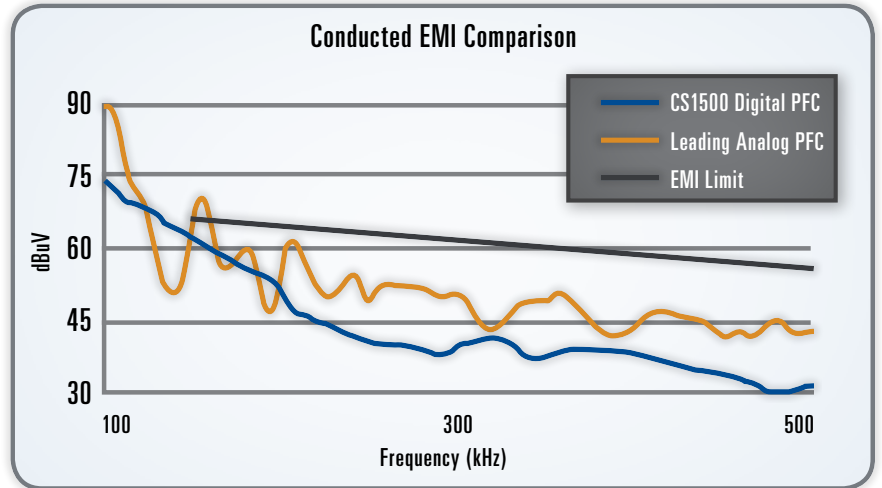
- Variable switching frequency
  - The average switching frequency is varied with respect to the line voltage spreading energy over a wide frequency band.
  - The switching frequency is highest at the peak of the input voltage which minimizes peak currents
- Digital Spread Spectrum
  - Shapes colored noise eliminating EMI noise spikes
- Peak current amplitude spreading
  - Provides additional spreading and further reduces EMI peaks.

**KEY VALUES**

- Digital noise shaping dramatically decreases the size and cost of the EMI filter
- Variable frequency DCM enables superior efficiency under all load conditions
- Low external component count
- Comprehensive on-chip protection
  - Under Voltage Lockout
  - Brownout
  - Over Voltage
  - Open Loop
  - Over Power

**EVALUATION MODULES AND REFERENCE DESIGNS**

- CDB-CS1500- 100W PFC Only
- CRD-CS1500-FB 75 W Notebook Adapter Reference Design
- CRD-CS1500-LLC 90 W Notebook Adapter Reference Design
- CRD-CS1500-LLC 250 W TV/PC Power Reference Design



**REFERENCE DESIGN 90W CS1500 + FLYBACK**

CS1500 Digital PFC + Flyback second stage demonstrates the expected performance of Cirrus Logic new digital energy controller. The combined solution allows a simple one layer board and world class efficiencies under all load conditions. CS1500's Digital EMI Noise Shaping enables the simplification and reduction of EMI filter components allowing for smaller more efficient designs at any power level.

**REFERENCE DESIGN 90W CS1500 + LLC**

Demonstrating ultra high efficiency, the CS1500+LLC reference design provides the best efficiency and smallest EMI filter for power levels up to 300 W. The Digital EMI Noise Shaping is utilized to shape both PFC and 2nd differential and common mode EMI noise. Efficiencies for this design are ~90% with unmatched performance under all load conditions with considerable power dissipation advantages under light load and no load conditions. This solution can be referenced for the development of high end laptop adaptors, PC Power, and low profile DTV Power.

**REFERENCE DESIGN 230W CS1500 + LLC**

This reference design demonstrates CS1500's unique ability to mitigate EMI noise, even at higher rated power level. Typical power supply designs for power levels > 200 W previously required more expensive Continuous Conduction Mode (CCM) technology, but with Cirrus Logic's Digital EMI Noise Shaping technology, cost effective Discontinuous Conduction Mode (DCM) topologies can scale up to 300 W. Cirrus Logic EXL Core technology enables the optimization of switching frequency and duty cycle, for all power levels, line voltages, and load conditions, thus providing users with the optimal energy controller for any PFC enabled product.

For the full datasheet, visit [www.cirrus.com/support](http://www.cirrus.com/support).

Part Number	Control Method	Max $f_{sw}$ [kHz]	Frequency Spreading	Peak Current Spreading	IC Supply Current [mA]	$V_{in}$ Range [V]	$T_j$ Op. Range [°C]	Gate Driver (Source/Sink) [Ω]	Internal Feedback Compensation	Package
<b>CS1500</b>	VF-DCM	70	√	√	1.9	7.9 – 17.0	-40 to +125	9 / 6	√	SOIC-8