

NXP TEA2016 LLC RESONANT CONVERTER DESIGN TOOL

The NXP LLC resonant converter design tool helps engineers bridge design and decision-making gaps from system specifications to a complete set of paper designs with the help of a simple, sequential design flow.

OVERVIEW

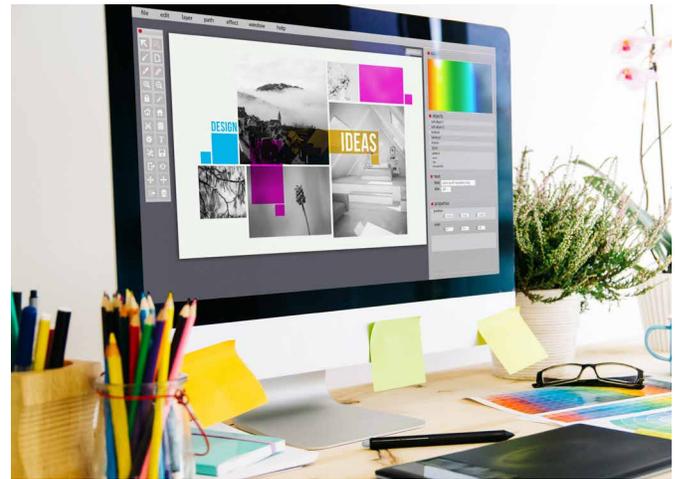
Completing and optimizing a near production-ready resonant converter design can be tricky, tedious, and even challenging. The main focus of the design tool is to address common issues/concerns proactively, such as worst corner case stress of each device, device tolerance/distribution effects to performance, and design optimization. As a result, we can cut design iteration, trial-and-error effort on bench, and development time. The design tool is written in Excel and can be downloaded from the NXP web site.

FEATURES AND BENEFITS

- Detailed step-by-step sequential flow helps engineers to follow and complete designs easily
- Proactively assess worst-case and corner-case stress and thermal of devices
- Proactively assess device tolerance/distribution effects to system performance
- Fine knobs and guidelines to help engineers fine-tune design toward optimization
- Complete a paper design with schematic, BOM, and magnetic build sheets for the whole system
- Combining FHA-based LLC design with a downloadable SIMPLIS simulation mode helps saving iteration cycles

APPLICATIONS

- Desktop and all-in-one (AIO) PCs
- Gaming consoles
- TV power supplies (Ultra HD, 4K)



- Notebook adapters
- Lighting applications up to 350 W

SUPPORTING PRODUCTS

The TEA2016 is a digital configurable LLC and PFC combo controller. It provides high efficiency across all power levels. Combining with the TEA1995T/TEA2095T(TE) dual LLC resonant SR controller further enhances system efficiency at low cost.

A new generation of active bridge rectifier (ABR) TEA2208T/TEA2209T/TEA2206T controllers are introduced recently. Compared to conventional diode bridge rectifiers, these ABR can improve the power converter efficiency significantly.

- TEA2016AAT: Digital controller for high-efficiency resonant power supply
- TEA1995T/TEA2095T(TE): Dual synchronous rectifier controller
- TEA2208T/TEA2206T/TEA2209T: Active bridge rectifier controller

DESIGN TOOL BLOCKS AND FLOW

Six design blocks are available: Ringo setting, PFC design, LLC design, magnetic implementation, analysis, and schematic and BOM. The sequential flow runs from left to right as shown on spreadsheets at the bottom of the Excel file. For each design block, the flow runs from top to bottom sequentially.

HOW TO USE THE TOOL?

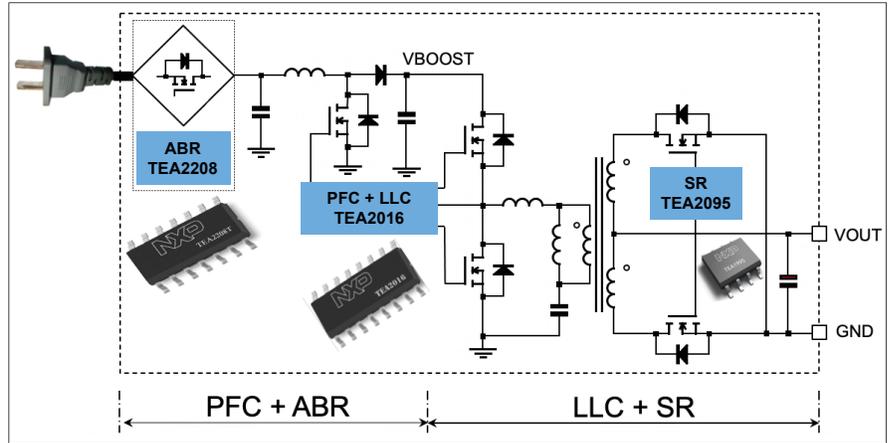
The Excel-based design tool is self-explanatory. The design tool UI and a few key elements are highlighted below.

- User input: To enter design or component parameters
- Default: Recommended parameters or calculation results
- Graphic area: To illustrate contents better
- Real-time design guides: Hover over "User input" or a description and a note pops up with an explanation or a design recommendation
- Precaution: If an entered "User input" is way off any reasonable design range, a "Caution" or "Warning" message pops up with an explanation or guidelines

NXP GREENCHIP SOLUTIONS

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

SYSTEM CONFIGURATION: PFC + LLC RESONANT CONVERTER + ABR + SR



DESIGN TOOL BLOCKS AND FLOW

User Input Default/Recommend Graphic

LLC Resonant Converter Design Tool
- PFC + LLC: TEA2016, Active Bridge Rectifier: TEA2208/TEA2209/TEA2206, SR: TEA1995/TEA2095

LLC Design: Step 1. In/Out Spec. Step 2. Ini. Settings Step 3. Power Plan Step 4. LLC MOSFET Step 5. TEA2016 Pk. Step 6. Output Cap. Step 7. Output Rectifier Step 8. Compensation

Note: "User Input" is for users to enter typical design or component parameter; "Default" is recommended typical parameter or calculation result.

1. Input/Output Specifications

1.1. Input Specifications

User Input	Default	Unit
Min AC line voltage	90	Vrms
Max AC line voltage	264	Vrms
Max ambient temperature	50	C
Min PFC output voltage for hold-up time	289.2	V
Min PFC regulated output voltage (Min VBOOST)	392.9	V
Typ PFC regulated output voltage (Typ VBOOST)	420.0	V
Max PFC regulated output voltage (Max VBOOST)	427.1	V
Max PFC output OVP voltage (OVP VBOOST)	427.1	V

1.2. Output Specifications

User Input	Default	Unit
Nominal output voltage (Vo)	12	V
Max nominal output current (Io)	20	A
Max nominal output power	240.0	W
Over power output current	25	A
Over Power output power	300	W
CV regulation tolerance (+/-)	3	%
Max output voltage ripple (+/-)	3	%
Max output peak-to-peak ripple (+/-)	5	mV
Peak transient voltage deviation at load release ($\Delta V_o/V_o$)	5	%
Output over voltage protection (OVP) ratio	125	%
Max output voltage (at OVP)	15	V

1.3. Output Rectifier Design Concept

Rectifier winding type

User Input Default Unit

Center tap Bridge

Rectification type

SR rec Diode rec

Ringo PFC_Design **LLC_Design** Magnetic_Implementation Analysis Schematic_BOM

Design Flow

Design Blocks