

Introduction

MPS is committed to providing users with a variety of simulation solutions, including SIMPLIS models, SPICE models, DC/DC converter design models, and [Virtual Bench Pro](#).

The easy-to-use Design Assistant is the most popular tool provided by MPS, and its demand continues to grow each year. Figure 1 shows the annual growth of how often our Design Assistant is requested and utilized.



Figure 1: Design Assistant Proportion Analysis

In particular, the Design Assistant for [AC/DC products](#) is popular because of its wide range of products and comprehensive design functions.

To simplify the Design Assistant, MPS officially launched new Design Assistant files for AC/DC products in May 2021. These new files included functional enhancements, interface updates, and QA testing. Figure 2 shows how the [AC/DC Design Assistant](#) was downloaded more often on a month-by-month basis as a result of this update.

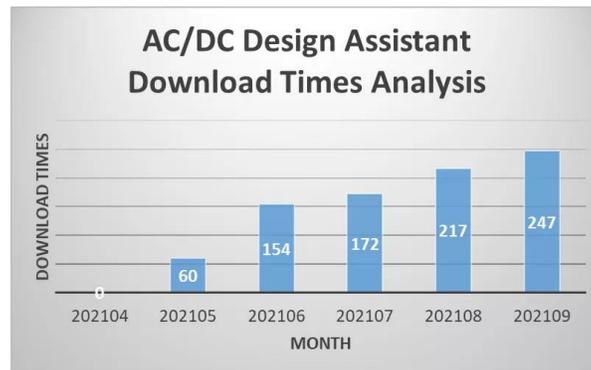


Figure 2: AC/DC Design Assistant Monthly Downloads

This article will explore the advantages of the [AC/DC Design Assistant](#).

Improved Design Assistant Interface

The revamped Design Assistant adopts a similar interface style to the MPS website, creating a harmonious and unified user experience. The text specifications are uniform for parameters such as input, output, and annotation. Figure 3 shows the new Design Assistant interface.



| 1. System Spec | | | |
|-----------------------------------|---------|-------|----------|
| Input Spec | | | |
| Minimum Line Voltage | Vac_min | 85 | V |
| Maximum Line Voltage | Vac_max | 265 | V |
| Line Voltage Frequency | fline | 50 | Hz |
| Output Spec | | | |
| | Vo(n) | | IoMax(n) |
| Output1 | 24 | V | 1 A |
| Output2 | 0 | V | 0 A |
| Output3 | 0 | V | 0 A |
| Output Power | 24 | W | |
| Estimated Efficiency | | | |
| | η | 0.82 | |
| Input Power | Pin | 29.27 | W |
| Switching Frequency | fs | 55 | kHz |
| Capacitance connected to FSET pin | C_FSET | 470 | pF |

Figure 3: The New Design Assistant Interface

The Instruction page makes it easy for users to get started by providing clear guidance and assistance, in addition to annotating the design steps for each page. For users who want more details about the design process, the Detailed Instruction page covers the design steps of each key parameter.

Figure 4 shows the Design Assistant guide interface.



Version 1.0
Date: 2021 March 31st
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This spreadsheet is used for Fixed Frequency Flyback Controller Design based on HFC0300, which needs further bench verification.

01_Circuit Design

- 1 Circuit Design includes 01_Basic Parameters:
- 2 Input required specs in blue font, like **Vin_ac_min 85 V**
- 3 Step by step, get recommended results, like **Pin 29.27 W**
based on input;
- 4 take the note besides: **Vro=N x (Vo+Vi), Typically, 85-135 V** as reference to check the data validity;

Next Step

Figure 4: Design Assistant Guide Interface

The current [AC/DC Design Assistant](#) covers products such as flyback applications, power factor correction (PFC) applications, LLC applications, and all-in-one applications. Most tools include the external circuit design, as well as transformer design. The design files support one-click printing, which allows users to obtain a preliminary design and quickly validate their design performance in conjunction with other MPS simulation models. As a result, MPS has effectively shortened and simplified the development process.

Design Assistant Set-Up

To set up Design Assistant, follow the steps below.

1. Navigate to the [Products](#) page on the MPS website, and filter through the AC/DC product line to select the relevant product.

- On the product page, click "XLSX" under the "Design Resources" tab to download the tool without having to log in.

Consider the [MPX2001](#), an all-in-one flyback controller that integrates a primary driving circuit, secondary controller, and synchronous rectification driver. This article uses the [MPX2001](#) to showcase the Design Assistant and verify its functionality using the SIMPLIS model in SR mode.

Figure 5 shows the Design Assistant download interface on the [MPX2001](#)'s detail page.

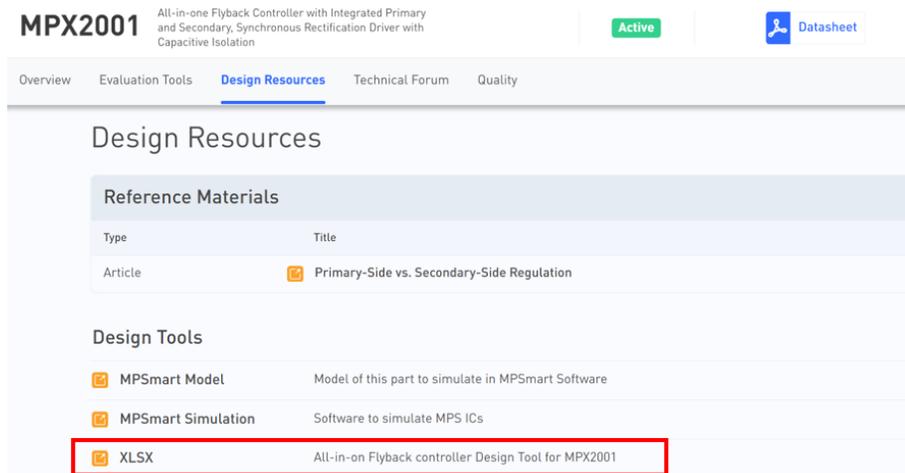


Figure 5: MPX2001 Design Assistant Download Interface

- Download and save the [MPX2001](#) Design Assistant and the [MPX2001](#) SIMPLIS model, which are both under the "Design Tools" tab.
- Enter the basic parameters based on the prompts in Design Assistant and modify the recommended values in the SIMPLIS model.

Figure 6 shows an example regarding the [AC/DC Design Assistant](#)'s input capacitor parameter. The input capacitor value is determined using the input power supply and the input capacitor power coefficient ($K_{InputCAP}$).

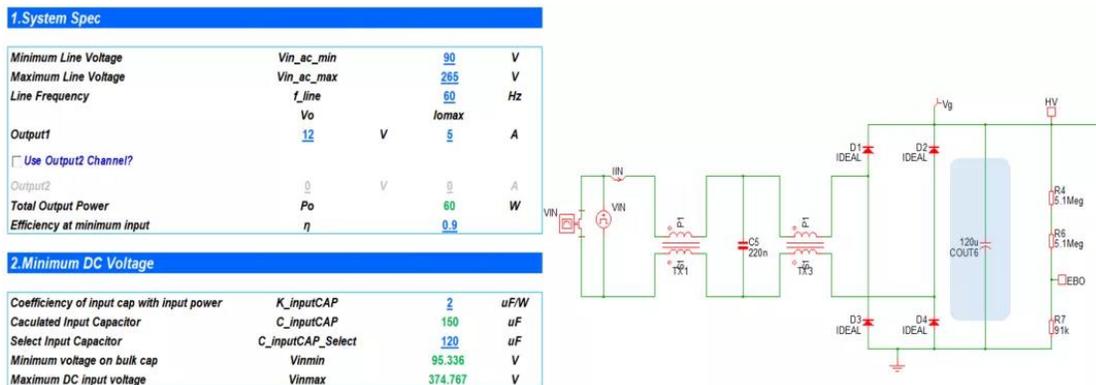


Figure 6: Input Capacitor of the AC/DC Design Assistant

Figure 7 shows an example of the [AC/DC Design Assistant](#) regarding transformers. Depending on key parameters — such as the primary-side equivalent output voltage (V_{RO}) and current ripple coefficient (K_P) — the transformer ratio, primary-side MOSFET tube pressure resistance, and primary inductance (L_M) can all be determined.

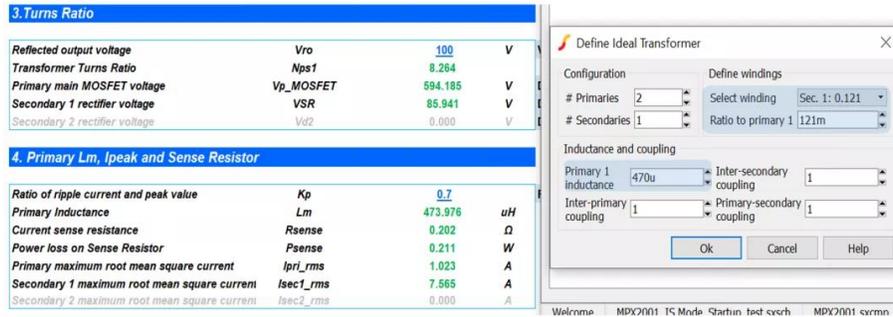


Figure 7: Transformer of the AC/DC Design Assistant

The output capacitor is selected based on the output voltage ripple (see Figure 8). Other designs, such as the RCD snubber circuit, compensation network, and EBO resistors are selected in a similar manner.

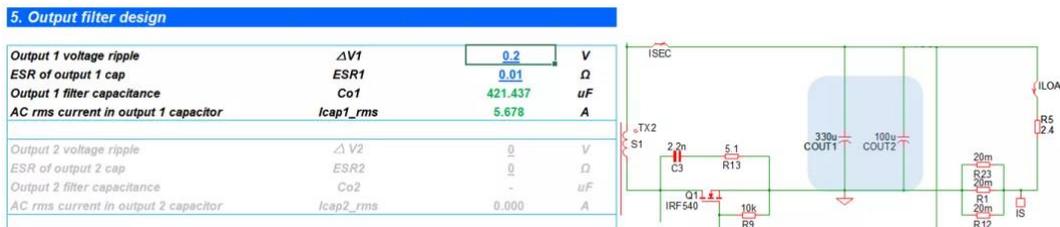


Figure 8: Output Capacitor of the AC/DC Design Assistant

Figure 9 shows the [MPX2001](#) simulation results created by the Design Assistant using the SIMPLIS software. The user can see the waveforms of the primary and secondary voltages, currents, and other key nodes based on the design.

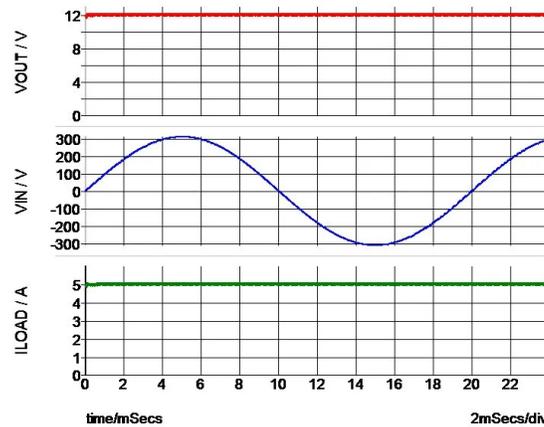
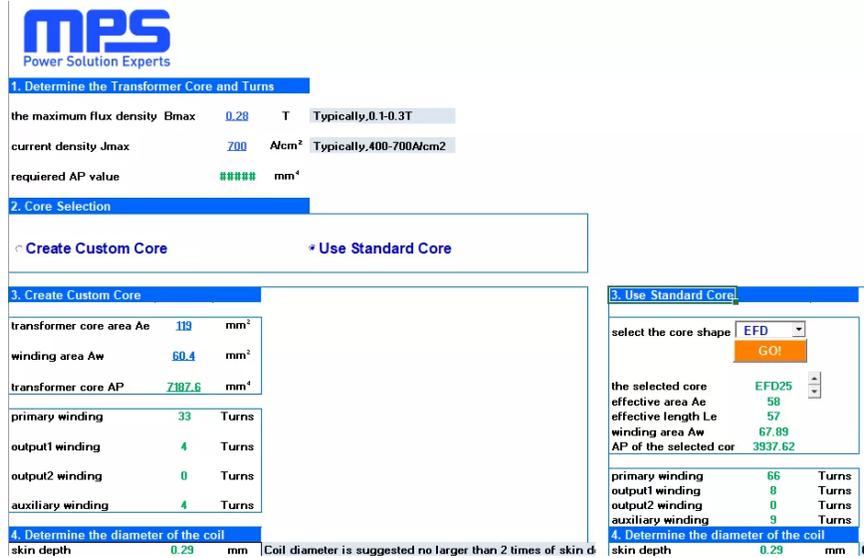


Figure 9: MPX2001 SIMPLIS Model Simulation Results

Once the main circuit is determined, the user enters the B_{MAX} and J_{MAX} values on the Transformer Design page. These values can be selected by either using the recommended core AP, or manually entering the transformer parameters to obtain specifications (e.g. the number of turns and diameter).

Figure 10 shows the Transformer Design page of the [AC/DC Design Assistant](#).



1. Determine the Transformer Core and Turns

the maximum flux density Bmax 0.28 T Typically, 0.1-0.3T

current density Jmax 700 A/cm² Typically, 400-700A/cm²

required AP value ##### mm⁴

2. Core Selection

Create Custom Core Use Standard Core

3. Create Custom Core

| | | |
|--------------------------|--------|-----------------|
| transformer core area Ae | 119 | mm ² |
| winding area Aw | 60.4 | mm ² |
| transformer core AP | 7187.6 | mm ⁴ |
| primary winding | 33 | Turns |
| output1 winding | 4 | Turns |
| output2 winding | 0 | Turns |
| auxiliary winding | 4 | Turns |

4. Determine the diameter of the coil

skin depth 0.29 mm | Coil diameter is suggested no larger than 2 times of skin d

3. Use Standard Core

select the core shape EFD

the selected core EFD25

| | |
|------------------------|---------|
| effective area Ae | 58 |
| effective length Le | 57 |
| winding area Aw | 67.89 |
| AP of the selected cor | 3937.62 |

| | | |
|-------------------|----|-------|
| primary winding | 66 | Turns |
| output1 winding | 0 | Turns |
| output2 winding | 0 | Turns |
| auxiliary winding | 9 | Turns |

4. Determine the diameter of the coil

skin depth 0.29 mm |

Figure 10: AC/DC Design Assistant Transformer Design Page

Conclusion

MPS' improved Design Assistant provides strategic advantages that shorten the development process. This article explored [AC/DC Design Assistant](#) with the [MPX2001](#), and verified its set-up process and functionality. Moreover, the MPS website includes Design Assistant files for other circuits, such as LLC applications and LR design.