

### 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](#).

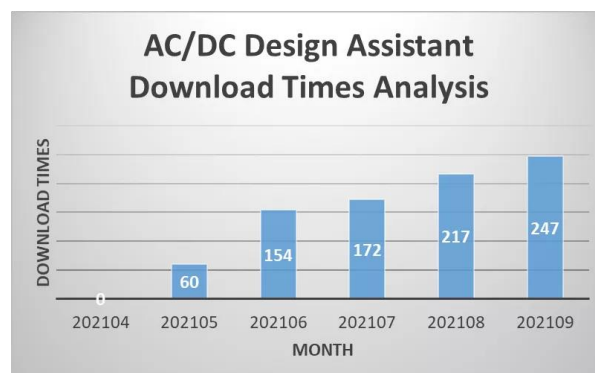
The easy-to-use Design Assistant is the most popular tool provided by MPS, and its demand continues to grow each year. Figure 1 shows the annual growth of how often our Design Assistant is requested and utilized.



**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				
<b>Input Spec</b>				
Minimum Line Voltage	Vac_min	85	V	
Maximum Line Voltage	Vac_max	265	V	
Line Voltage Frequency	fline	50	Hz	
<b>Output Spec</b>				
	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.

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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

- Circuit Design includes 01\_Basic Parameters;
- Input required specs in blue font, like **Vin\_ac\_min** 85 V
- Step by step, get recommended results, like **Pin** 29.27 W  
based on input;
- 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

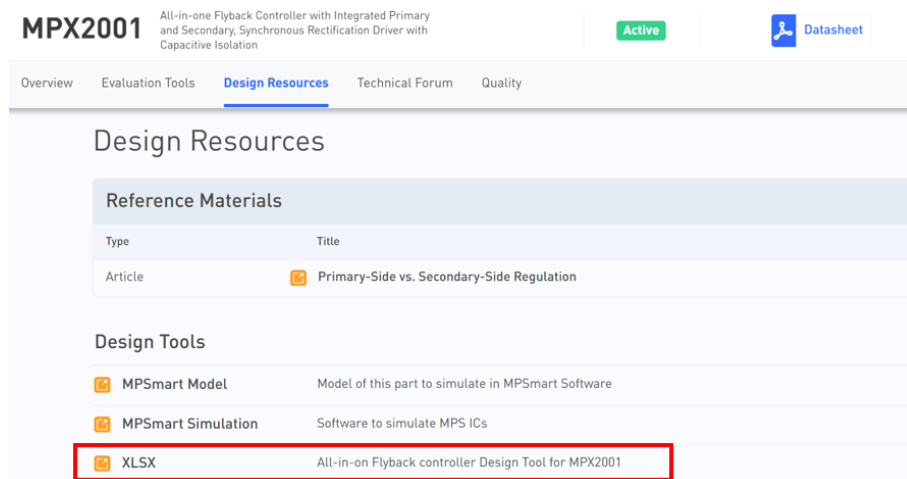
To set up Design Assistant, follow the steps below.

- 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.

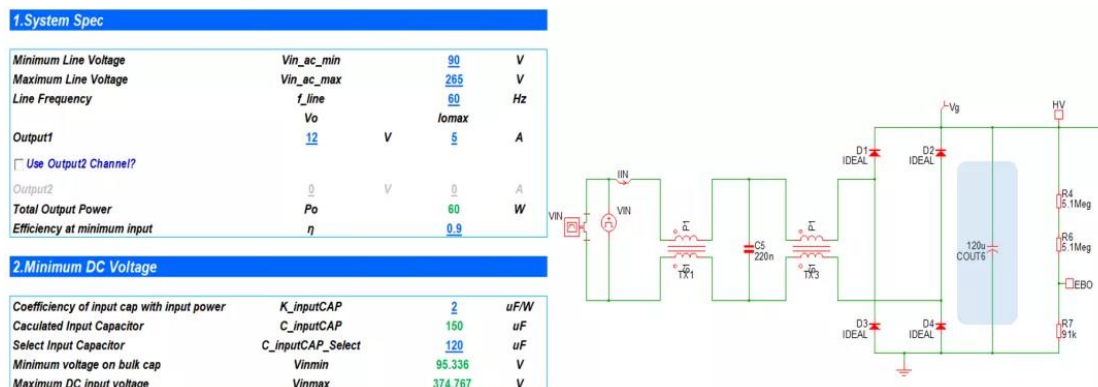
Figure 5 shows the Design Assistant download interface on the [MPX2001](#)'s detail page.



**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.

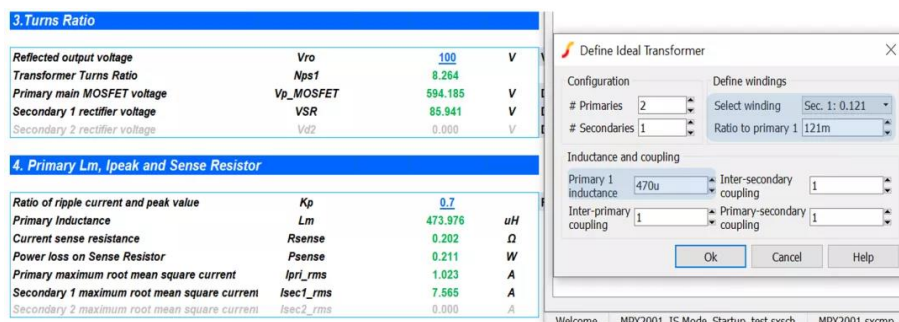


Figure 7: Transformer of the AC/DC Design Assistant

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.

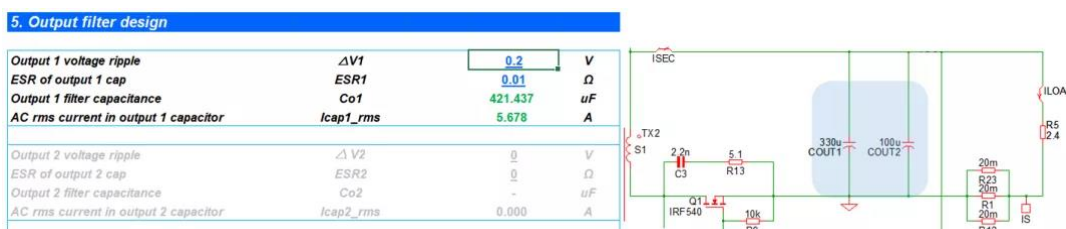


Figure 8: Output Capacitor of the AC/DC Design Assistant

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.

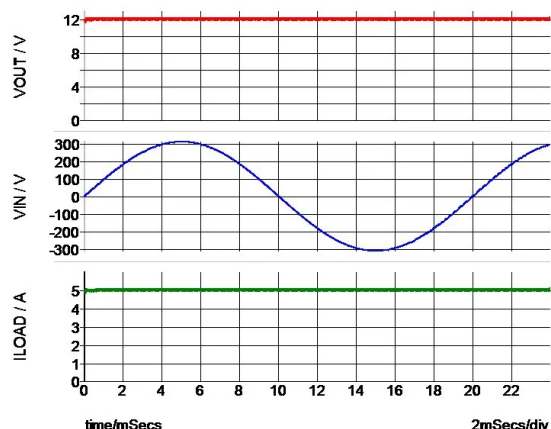


Figure 9: MPX2001 SIMPLIS Model Simulation Results

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/cm<sup>2</sup>

Typically, 400-700A/cm<sup>2</sup>

required AP value

#####

mm<sup>4</sup>

2. Core Selection

Create Custom Core

Use Standard Core

3. Create Custom Core

transformer core area Ae

119

mm<sup>2</sup>

winding area Aw

60.4

mm<sup>2</sup>

transformer core AP

7187.6

mm<sup>4</sup>

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

GO!

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.

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