

Vendor's Tool Automates Planar Magnetics Design For Power Supply Designs Using Its Offline Switcher ICs

[Power Integrations'](#) PI Expert online power supply design tool now features a planar magnetics builder that generates an application-specific planar transformer design, complete with printed circuit board (PCB) manufacturer-ready documentation and Gerber files. This latest version of PI Expert (version 2.7) also adds support for Power Integrations' entire InnoSwitch 3 flyback switcher IC family, which supports the design of ac-dc power supplies from about 10 W to 220 W. The PI Expert tool automatically generates optimized power supply designs based on the company's switching ICs according to users' specifications.

"Planar transformers facilitate low-profile flyback power supplies. With our new planar magnetics builder, designers can incorporate a sophisticated low-profile transformer in minutes. No other design tool can do this," said Trevor Hiatt, director of channel marketing at Power Integrations. PI Expert produces a standalone planar magnetic built on its own PCB, rather than a magnetic design embedded in the power supply PCB. See Fig. 1.

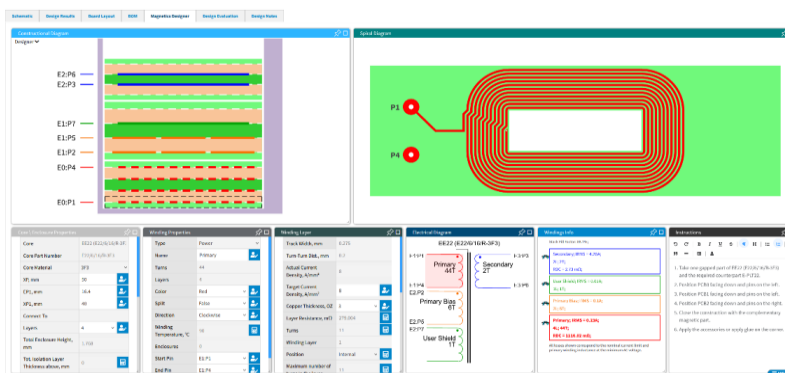
Planar magnetics have not traditionally been popular in mainstream designs and were usually reserved for use in high-density dc-dc converters because of factors such as cost and the specialized skills required to design them. However, to meet requirements for small size, these lower-profile magnetic components are now moving from dc-dc converters into mainstream ac-dc power supply applications such as small-size USB PD and PPS designs including those developed for wall sockets.

The magnetics designer function in PI Expert provides full planar transformer information including stack specification, vertical and horizontal PCB construction, trace parameters, current density information and layer resistance (Figs. 2 and 3). The tool automatically adds creepage and clearance distances necessary to meet safety isolation standards, though it will also accept user-defined values for these spacings.

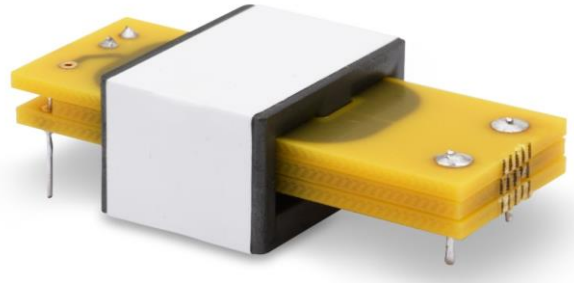
The tool provides a comprehensive database of planar cores and components to simplify design and can also accept custom core geometries (Fig. 4). PI Expert automatically optimizes the planar transformer design to match the power supply specification, incorporating additional winding layers and adjusting trace geometries as appropriate.

Along with the designer's specification of electrical requirements, the designer's core selection is a cornerstone of how the tool generates the planar magnetic design. Core size determines the winding window, which then drives the tool's engine to modify the design of the PCB including how much copper is needed and the number of layers, according to Andy Smith, director of technical outreach at Power Integrations.

According to the company, PI Expert leverages decades of PI's combined power supply design expertise and is used by tens of thousands of global engineers annually. For more information, see the PI Expert [page](#).



(a)



(b)

Fig. 1. PI Magnetics-Designer automatically generates a planar transformer design with full electrical specification and build documentation in just five minutes (a). Users enter electrical circuit parameters and the tool generates all aspects of the transformer design, except for the choice of the core. However users can override certain magnetics parameters, and with any changes made to circuit specifications or the transformer design, PI expert calculates winding temperature—one of the critical limits on transformer performance. An example 10-W planar transformer designed using PI Expert is also shown in (b).

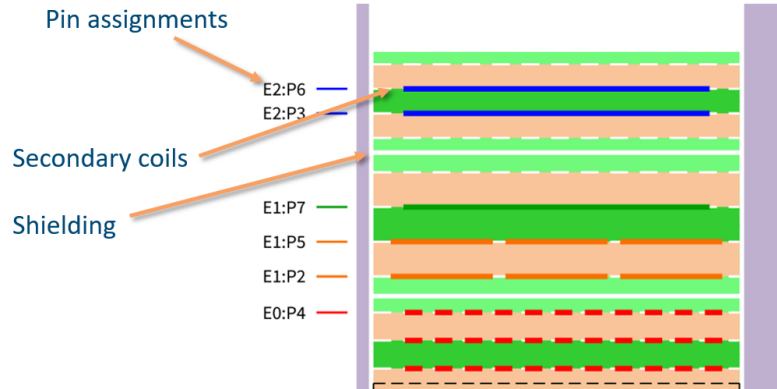


Fig. 2. An intuitive GUI provides vertical and horizontal stack construction and a bird's eye view for all layers. The tool also outputs detailed manufacturing information of the planar solution, enabling users to go directly from design to fabrication.

Core	EE22 (E22/6/16/R-3F3)
Core Part Number	E22/6/16/R-3F3
Core Material	3F3
XP, mm	50
EP1, mm	16.4
XP1, mm	48
Connect To	
Layers	4
Total Enclosure Height, mm	1.768

Type	Power
Name	Primary
Turns	44
Layers	4
Color	Red
Split	False
Direction	Clockwise
Winding Temperature, °C	90
Enclosures	0

Track Width, mm	0.275
Turn-Turn Dist., mm	0.2
Actual Current Density, A/mm²	8
Target Current Density, A/mm²	8
Copper Thickness, OZ	3
Layer Resistance, mΩ	279.004
Turns	11
Winding Layer	1

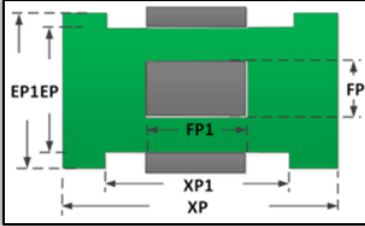
Fig. 3. PI Expert generates comprehensive build information for planar transformers. It also estimates transformer performance and incorporates this data into power supply performance.

Magnetics

Flyback Transformer Type: Planar Use Shield Windings

Core Material: Wire Wound
Planar High frequency power material for use in power and general purpose transformers (less than 700kHz)

Core Type	Pmax, W	AE, mm ²	LE, mm
E-PLT14 (PLT14/5/1.5/S-3F3)	4.5	14.50	16.70
ER14 (ER14.5/3/7-3F3-S)	6.4	17.60	19.00
EE14 (E14/3.5/5/R-3F3)	6.9	14.50	20.70
E-PLT18 (PLT18/10/2/S-3F3)	9.7	39.50	20.30
EE18 (E18/4/10/R-3F3)	15.1	39.50	24.30
E-PLT22 (PLT22/16/2.5/S-3F3)	22.6	78.50	26.10



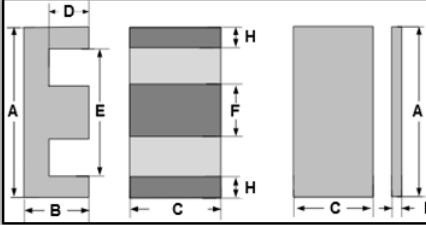


Fig. 4. PI Expert contains a comprehensive library of planar core types but also allows designers to add custom core parameters. Simple parametric-driven design choices optimize use of the winding window, while providing safe operation in corner-case conditions. The tool also allows users to switch to wirewound designs if desired.