

Create a Fly-Buck™ Converter in WEBENCH® Power Designer



Jonathan Arzadon

Designing an isolated power-supply solution can be quite complicated; you need custom transformers, different types of feedback networks for proper circuit regulation and some type of compensation for stability. But for certain applications, one solution can provide the same required isolated bias without many of these design complexities: the Fly-Buck™ converter.

For those unfamiliar with the topology, the Fly-Buck converter creates isolated outputs using a synchronous buck regulator and coupled inductor windings (Figure 1). These designs offer several advantages over more traditional isolated power topologies. Since the isolated output closely tracks the primary-side output voltage, there is no need for an optocoupler or auxiliary winding; plus, you can use a smaller transformer since the primary and secondary turns ratios are better matched. This approach results in an isolated power design with both a lower cost and a smaller footprint. It also makes designing a stable and accurate isolated supply much simpler.

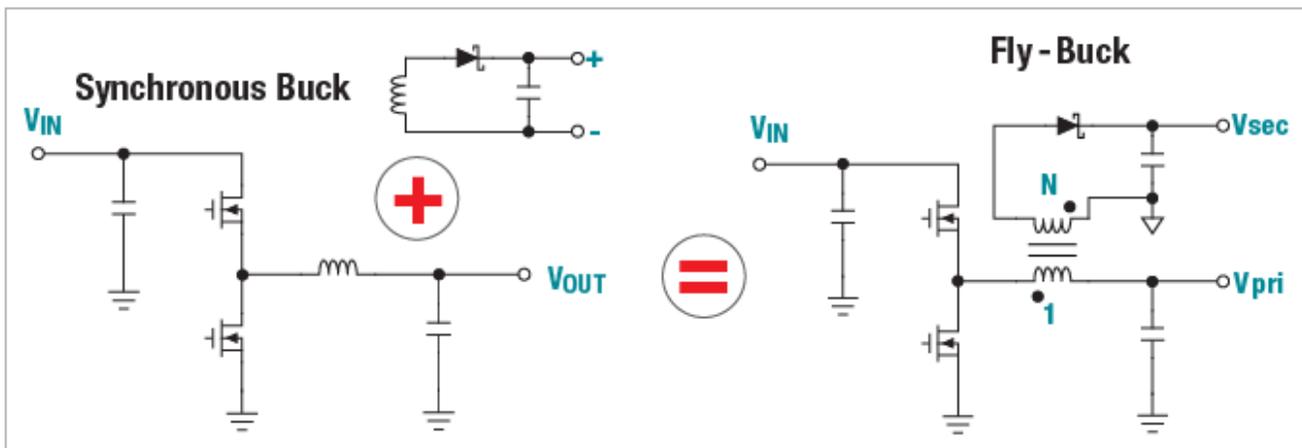
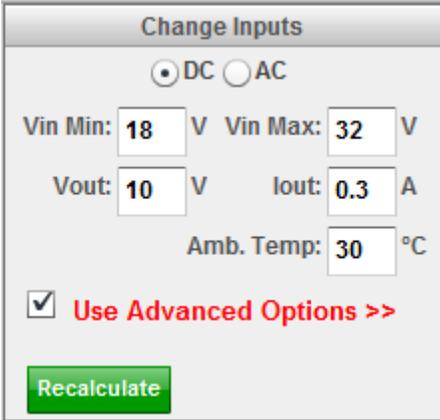


Figure 1. Fly-Buck Converter is Created by Adding Coupled Windings to a Synchronous Buck Converter

Whether you need a single isolated rail or a multi-rail power supply, [WEBENCH Power Designer](#) can now help you with your Fly-Buck designs. And just like any other power supply design, you have access to many of the useful features that WEBENCH Power Designer offers. Creating a WEBENCH Fly-Buck design is as simple as creating any other WEBENCH power supply design.

There are two ways to create a Fly-Buck design in WEBENCH Power Designer. The first method involves using the WEBENCH Designer panel. Using the panel, begin by clicking the “Start Design” button. Once the software has fully loaded, enter your Fly-Buck design requirements under the “Change Inputs” section (Figure 2).



Change Inputs

DC AC

Vin Min: V Vin Max: V

Vout: V Iout: A

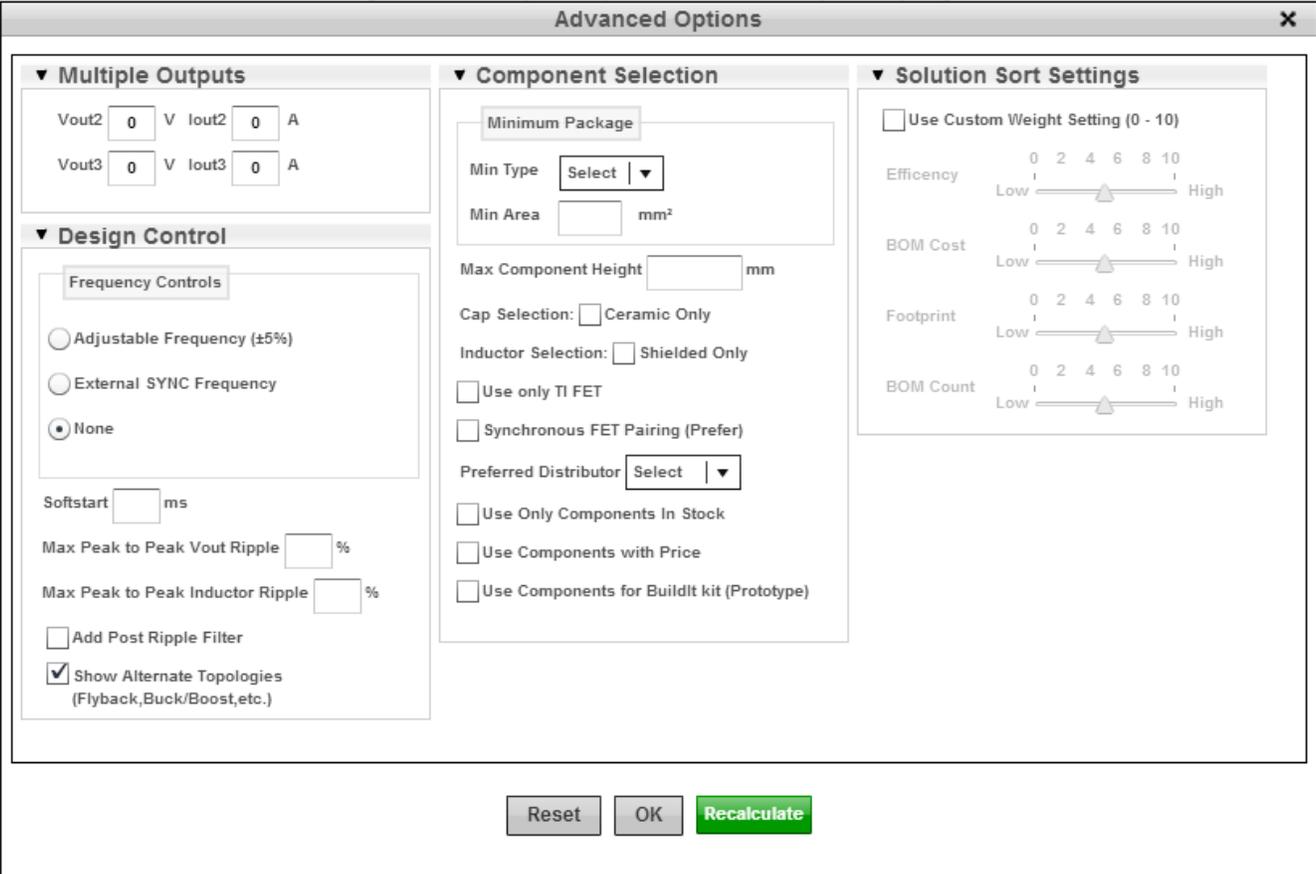
Amb. Temp: °C

Use Advanced Options >>

Recalculate

Figure 2. Enter the Power-supply Requirements for Your Fly-Buck Design Using the Change Inputs Section

Click “Use Advanced Options” to open up the Advanced Options menu (Figure 3). Under Design Control, make sure that the “Show Alternate Topologies” checkbox is selected so that all possible Fly-Buck solutions will be listed. Once you’ve confirmed the selection of that checkbox, click the “Recalculate” button to proceed.



Advanced Options

Multiple Outputs

Vout2: V Iout2: A

Vout3: V Iout3: A

Component Selection

Minimum Package

Min Type: ▼

Min Area: mm²

Max Component Height: mm

Cap Selection: Ceramic Only

Inductor Selection: Shielded Only

Use only TI FET

Synchronous FET Pairing (Prefer)

Preferred Distributor: ▼

Use Only Components In Stock

Use Components with Price

Use Components for Buildit kit (Prototype)

Solution Sort Settings

Use Custom Weight Setting (0 - 10)

Efficiency: Low High

BOM Cost: Low High

Footprint: Low High

BOM Count: Low High

Design Control

Frequency Controls

Adjustable Frequency (±5%)

External SYNC Frequency

None

Softstart: ms

Max Peak to Peak Vout Ripple: %

Max Peak to Peak Inductor Ripple: %

Add Post Ripple Filter

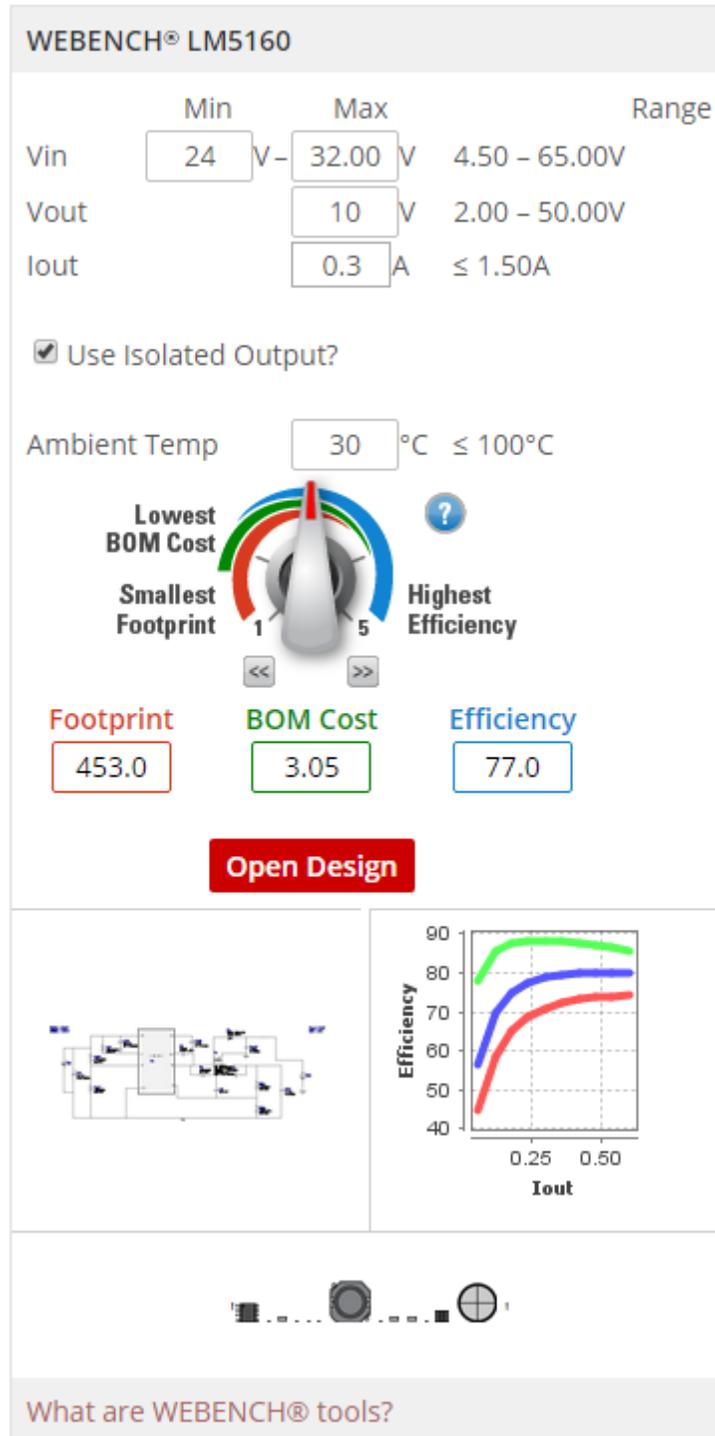
Show Alternate Topologies (Flyback, Buck/Boost, etc.)

Figure 3. Use WEBENCH Advanced Options to Show Alternate Topologies, Including Fly-Buck Designs

A list of viable solutions is provided in WEBENCH Visualizer, which allows you to easily sort and compare designs using different devices and topologies. Once you have found a Fly-Buck design that best suits your application, open it by clicking the “Open Design” button.

The second method requires you to know which device you plan to use for your Fly-Buck design. Let's say, for example, that you plan to use the LM5160 for your Fly-Buck design. In the LM5160 product folder, you will find a WEBENCH Designer panel created specifically for this device (Figure 4).

Using the WEBENCH panel, enter the input requirements for your Fly-Buck design. Before opening the design, make sure the "Use Isolated Output?" checkbox is selected. This ensures that the design created in WEBENCH Power Designer uses the Fly-Buck topology as opposed to a regular buck topology.



WEBENCH® LM5160

	Min	Max	Range
Vin	24 V	32.00 V	4.50 – 65.00V
Vout		10 V	2.00 – 50.00V
Iout		0.3 A	≤ 1.50A

Use Isolated Output?

Ambient Temp: 30 °C ≤ 100°C

Optimization Goals:

- Lowest BOM Cost
- Smallest Footprint
- Highest Efficiency

Footprint: 453.0 | BOM Cost: 3.05 | Efficiency: 77.0

Open Design

Efficiency vs Iout graph:

Iout (A)	Efficiency (%)
0.25	~75
0.50	~85

What are WEBENCH® tools?

Figure 4. Using the WEBENCH Product Folder Panel Allows You to Create a Fly-Buck Design Using a Specific Device Like the LM5160

Once the design is open, you can optimize the design with the optimization dial, view the design schematic, change the components in the bill of materials (BOM) window, print out a design report, or even share the design with a colleague (Figure 5).

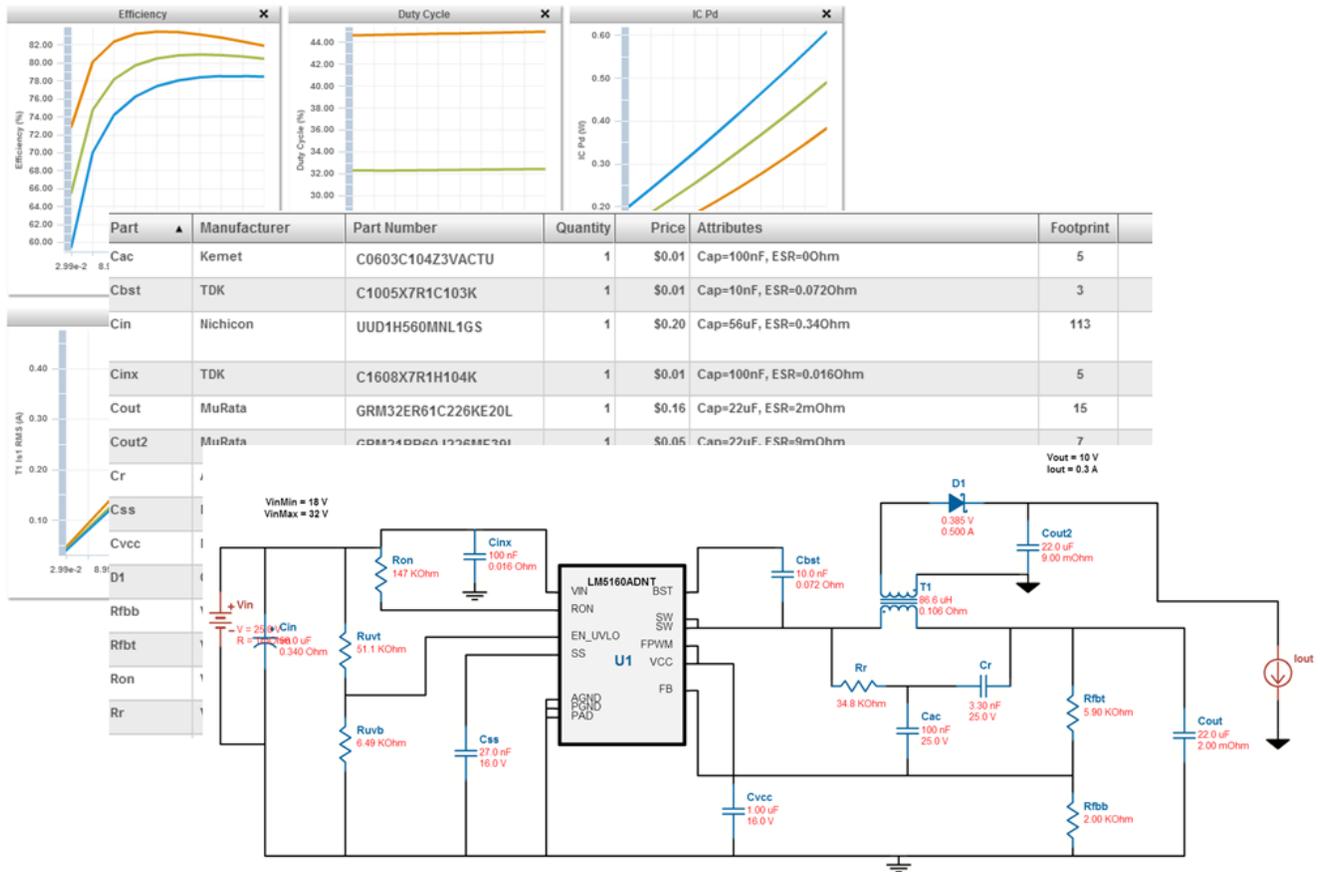


Figure 5. WEBENCH Tools Provide a List of Power-dissipation Values, a Complete BOM and a Schematic for Your Fly-Buck Design

You can even run SPICE simulations within WEBENCH Power Designer. Just click the “Sim” button, choose your simulation type (Steady State, Input Transient, Load Transient or Startup) and click “Start New Simulation”. When the simulation finishes, select the waveforms you wish to view in the Waveform Viewer (Figure 6). For further design customizations, WEBENCH Schematic Editor is also available.

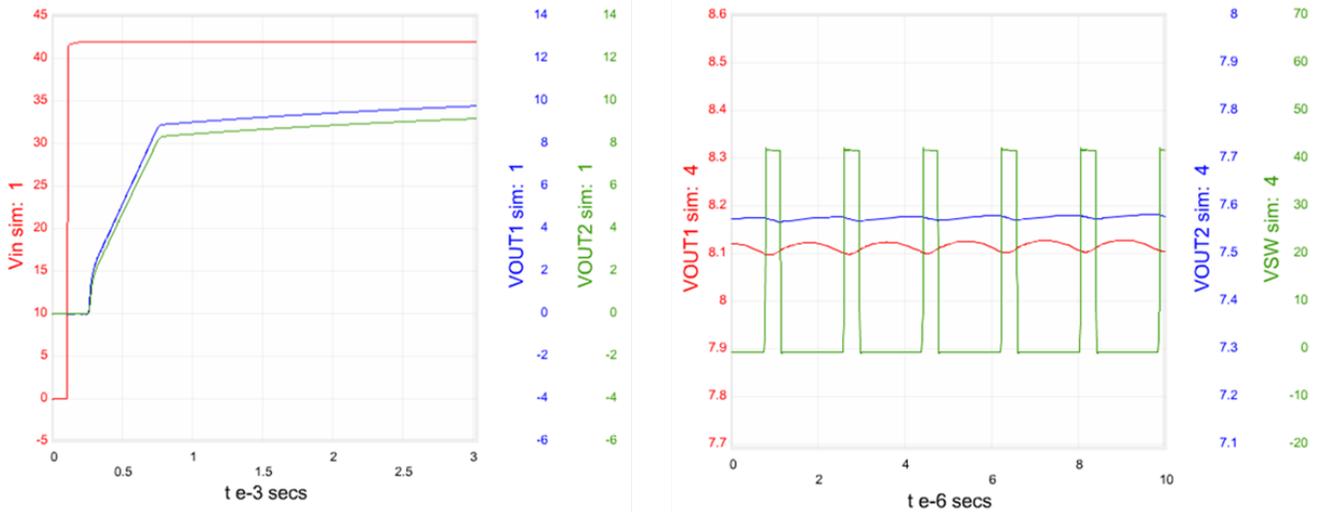


Figure 6. Startup and Steady-state Waveforms Generated for a Fly-Buck Design in WEBENCH Power Designer

WEBENCH Power Designer currently supports the LM5017, LM5018, LM5019, LM25017, LM25018, LM25019, LM5160A and TPS55010 in the Fly-Buck configuration, with plans to support more devices in the future.

Whether you've worked with Fly-Buck converters before, or it's your first time hearing about them, WEBENCH Power Designer makes designing these isolated power supplies quick and simple. In a matter of minutes, you'll have a Fly-Buck solution in front of you, ready to be optimized, customized, and analyzed within the WEBENCH environment. Try it out for yourself, and if you have any questions, feel free to leave us a comment below. You'll find that designing isolated power supplies has never been easier.

Additional Resources

- Check out this [WEBENCH LM5160 Fly-Buck design](#), or start a Fly-Buck topology design now in [WEBENCH Power Designer](#).
- Learn more about TI's multi-output [Fly-Buck topology](#).

IMPORTANT NOTICE AND DISCLAIMER

TI PROVIDES TECHNICAL AND RELIABILITY DATA (INCLUDING DATA SHEETS), DESIGN RESOURCES (INCLUDING REFERENCE DESIGNS), APPLICATION OR OTHER DESIGN ADVICE, WEB TOOLS, SAFETY INFORMATION, AND OTHER RESOURCES "AS IS" AND WITH ALL FAULTS, AND DISCLAIMS ALL WARRANTIES, EXPRESS AND IMPLIED, INCLUDING WITHOUT LIMITATION ANY IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT OF THIRD PARTY INTELLECTUAL PROPERTY RIGHTS.

These resources are intended for skilled developers designing with TI products. You are solely responsible for (1) selecting the appropriate TI products for your application, (2) designing, validating and testing your application, and (3) ensuring your application meets applicable standards, and any other safety, security, regulatory or other requirements.

These resources are subject to change without notice. TI grants you permission to use these resources only for development of an application that uses the TI products described in the resource. Other reproduction and display of these resources is prohibited. No license is granted to any other TI intellectual property right or to any third party intellectual property right. TI disclaims responsibility for, and you will fully indemnify TI and its representatives against, any claims, damages, costs, losses, and liabilities arising out of your use of these resources.

TI's products are provided subject to [TI's Terms of Sale](#) or other applicable terms available either on [ti.com](https://www.ti.com) or provided in conjunction with such TI products. TI's provision of these resources does not expand or otherwise alter TI's applicable warranties or warranty disclaimers for TI products.

TI objects to and rejects any additional or different terms you may have proposed.

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265
Copyright © 2023, Texas Instruments Incorporated