Introduction to the Vicor Filter Design Tool

The Vicor filter design tool helps you pick the most appropriate of various input filter topologies. Input filter could be set to filter out both input noise (*Vin*) and reflected input current ripple (*Iin*), by one common low pass filter.

Considerations outside of this tool's scope that pertain to designing filters for a DC-DC converter, include:

a) Input voltage ripple interaction with UVLO/OVLO.
b) Parasitic elements that can affect attenuation effects
c) Inductor / Capacitor variation over load and line.

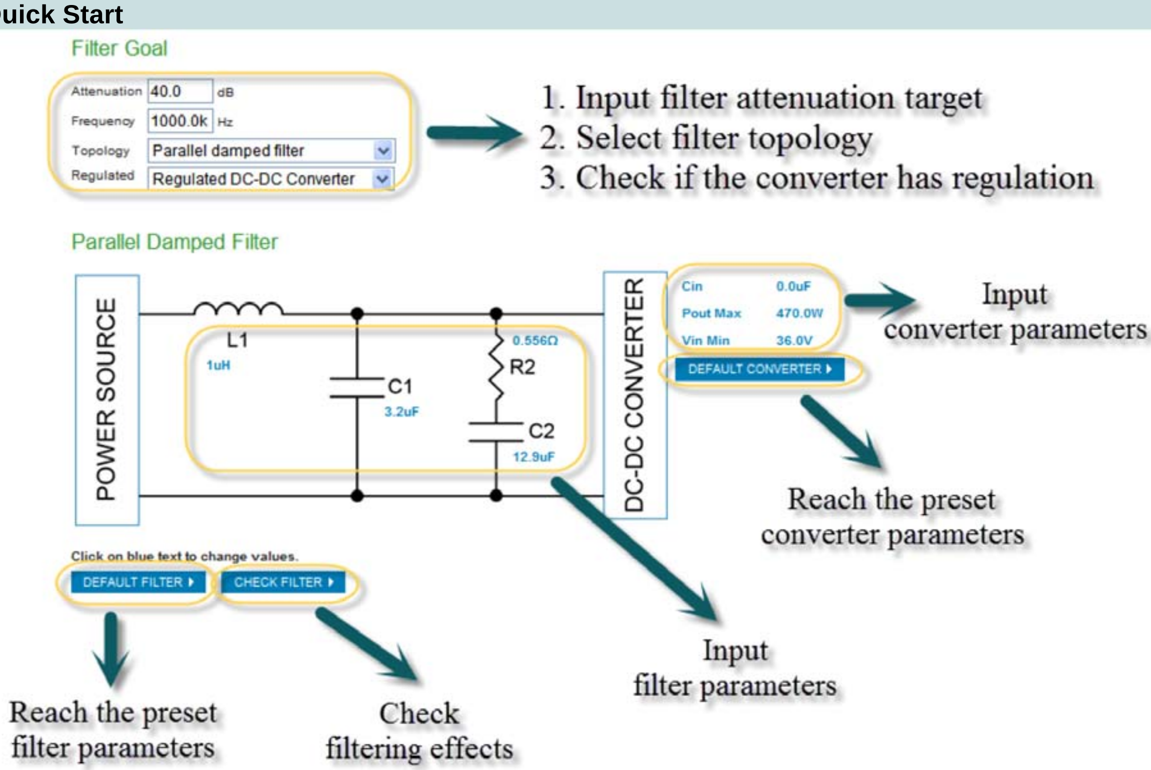
This tool comes with pre-set default parameters, which can speed up your design cycle. Once you choose your target and topology, by click on "DEFAULT FILTER", to select the pre-set parameters.

It can also help you to check input filter stability, which is important to input filter design for regulated DC-DC converter but is rarely covered by any existing tool.

There is an application note to introduce DC-DC converter filtering networks. The application notes serve as the background information of the input filter design tool. The parallel damped input filter topology is used to explain how to achieve the attenuation target, optimal damping, and system stability. The direct link to this Application note is:

http://www.vicorpower.com/documents/application_notes/vichip_appnote23.pdf

Quick Start



Step 1: Input the filter attenuation target. It can be targeted to either filter out input noise (*Vin*) or reduce reflected input current ripple (*Iin*);

Step 2: Select a filter topology;

Step 3: Check if the converter has regulation. There is no input stability issue involved for an unregulated converter;

Step 4: Input converter parameters, or use the preset converter parameters

Step 5: Input filter parameters, or use the preset filter parameters. You can use R to model the ESR of a capacitor.

Step 6: Click the "CHECK FILTER" button and check filtering effects.

Step 7: One example of filtering effects is shown below. If all the filtering effects check show "Yes", you have a working filter to fit your application. Otherwise, adjust filter parameters according to the instruction message, or adjust attenuation target, or switch topology, and check filter effects again, until the filter's performance fits your application.

Stability Calculation Assumes 90% of Converter Efficiency at Full Load

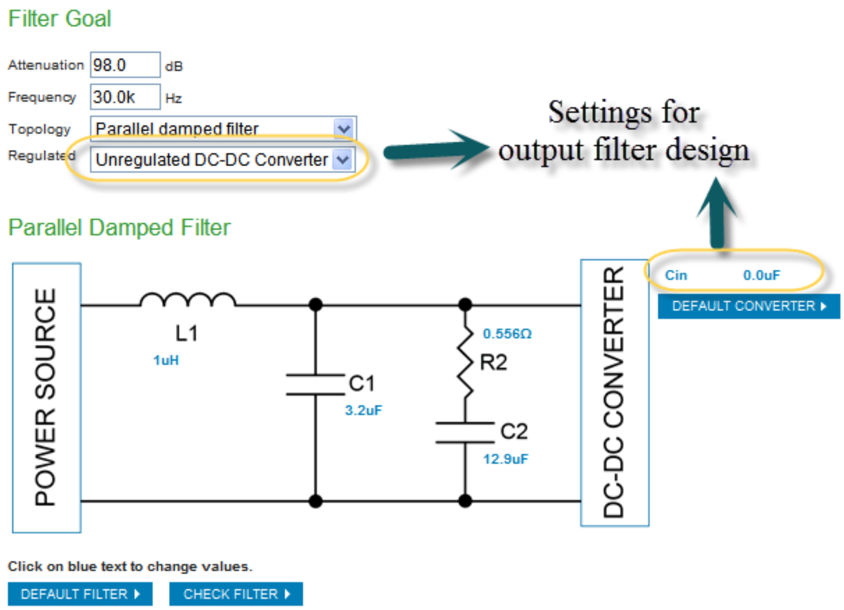
If you have a converter with efficiency less than 90% at full load, please enter Pin max in the "Pout Max" box.

No additional action is required for converter with full load efficiency over 90%. It just provides additional margin for stability.

Using This Tool for Output Filter Design

This tool is also capable of output filter design. Unless there is a downstream converter, there are two recommended settings in the filter design tool for use during output filter design:

a. Choose "Unregulated DC-DC converter", since there is no input stability issue involved anymore;
b. Make Cin=0.



Modifying the Default Filter

The preset default filter cannot guarantee that the attenuation target is met 100% of the time, optimally damped, and with a stable system. In addition, you may want to modify it in order to meet your application needs.

You can input any positive value to the filter parameters and check the filtering effects by clicking on "CHECK FILTER". To get the similar attenuation to the default filter, you can simply multiple all the inductance and resistance values by a ratio of k (k is a positive real number, does not have to be larger than 1), and multiply all the capacitance values by a ratio of 1/k. Be sure to click the "CHECK FILTER" button every time after you revise the parameters to update the results.