Support for the Designer—Improved ADI WebSite Helps You

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We have recently reconfigured the Analog Devices website to make it easier to use. If you are an old friend, perhaps you've already found that www.analog.com is friendlier than ever. If you are new to our website, Welcome! As you explore it, you'll find much useful information, and you'll have the ability to interactively find and apply the best products for your designs, using information listed under the two major tabs on the Home Page: *Products* and *Design Center.*

There you will discover utilities to find the right product for your application—and tools to help you use that product successfully. Utilities that assist in product selection include *parametric searches, selection tables,* and *signal chains.* Tools that assist in implementing the products include *models, interactive design tools, Analog Wizards, SimPLL,* and *SimADC.* These analog tools can be found in our Design Center (www.analog.com/designcenter), which also includes useful links to DSP tools, evaluation boards, and the library of technical information readily available from ADI.

The most powerful product selection tool on the site is the *parametric search.* When you know the specifications a device must have, the parametric search tool is the fastest way to find products to meet those requirements. The parametric searches allow you to specify a great many performance characteristics of a device. For example, the *op-amp* parametric search normally loads with 11 commonly used parameters—and 22 additional parameters can be added to the table to narrow the search. To keep the table from being too large, you can remove columns that are irrelevant to your design. The links to the analog-product parametric search tool can be found next to the *search* field on most pages of the corporate site.

Parametric searches are currently available for

- Op amps
- DACs
- Multiplexers
- Linear regulators
- References
- ADCs
- Switches
- Interface products
- Supervisory circuits

To use the parametric search, check the *include parameter* boxes to use the desired parameters, or uncheck the boxes to ignore those that are not of interest. Check the *priority* boxes to identify the parameters that are more important. To optimize a search on a specific parameter, type "best" in its *query parameter* field. For example—when looking for the lowest-power op amp that meets certain specs for headroom, supply voltage, and package—you would type "best" in the *quiescent current* column and specify the remaining requirements in the other columns. The search returns a list of all parts that meet the requirements. If there are fewer than 10 parts with the specs that are needed, the search will also return parts that almost meet your needs. Clicking on the down or up arrow for a given parameter will sort the list from highest to lowest or lowest to highest. Any required specs that are not met by a listed product will be highlighted in red. To get more information about a specific listed product, click on the model number to access its product page—which links to the data sheet.

Another product selection tool is the set of customizable *selection tables*, which can be found in the Design Center under Parametric Selection Tables, or under the Products tab. Selection tables are used to search through a smaller subset of products. Most of the selection tables on the Analog Devices site are *interactive*, allowing products to be sorted according to the parameters most important to the design. These tables let some parameters be selected with drop-down options; others can be sorted using the up/down arrows. For example, when using the interactive selection table for comparators, click on *customize table* for access to customizable parameters; select the logic level, then sort on the propagation delay. To get more information about a specific listed product, click on the model number to access the product page.

To find a part that ADI recommends for a specific application, a *signal chain* is a good place to start. Signal chains can be found at the top of the right-hand column of the Design Center. They are classified by market, and then by application within that market. The interactive signal chain for a selected application shows a block diagram implementation of that application (see Figure 1). The blue icons in the signal chain represent products that can be furnished by Analog Devices. Clicking on a blue icon will display a menu of product types that are applicable for that block. In the digital-camera signal chain, for example, clicking on audio amplifier will display the selections of audio amplifier, output amplifier, and volume control. Clicking on any of these will provide an interactive selection table of appropriate products. For each selected product, a single click will add it to a list that may be used for further in-depth study—or for ordering samples.

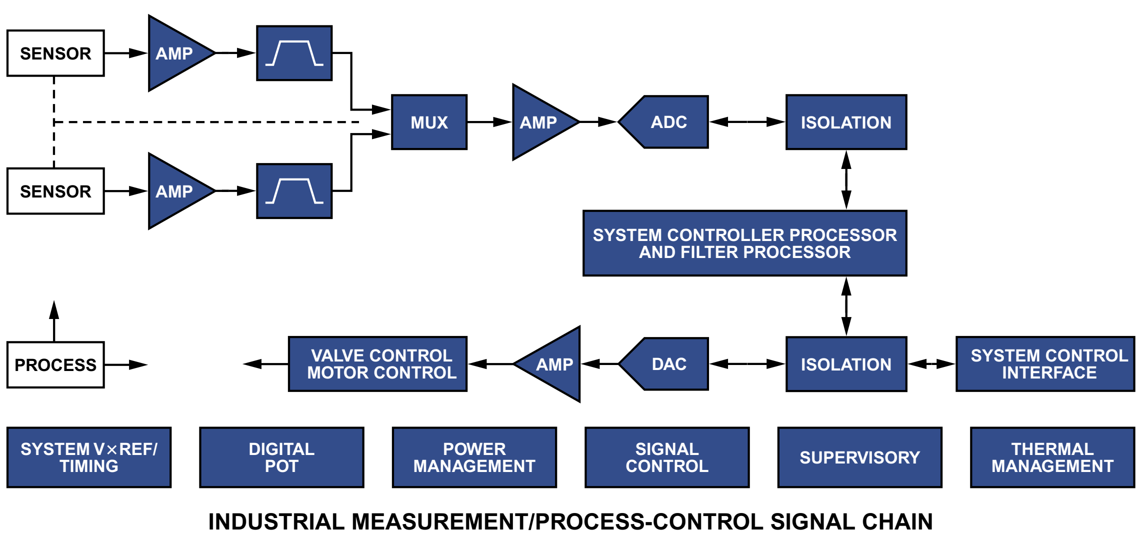

Figure 1. A typical signal chain.

In addition to helping find the appropriate products, the Design Center has tools that can be used to shorten design time. Analog Devices has a suite of models, online tools, downloadable tools, and evaluation boards available. SPICE models are available for many op amps, instrumentation amps, references, and analog multipliers. ADI's SPICE models can be used to closely replicate transient and ac device performance. IBIS models, used to model the input and output characteristics of a device, are available for ADCs, DACs, and DSPs. *Saber* models are available for some instrumentation amps.

ADI also offers interactive design tools to predict the behavior of some devices. For many op amps and instrumentation amps, there are error-budget and voltage-range calculators. The voltage-range calculators are invaluable for working through an in-amp design in which the internal nodes can become saturated. Equations in the data sheet come to life when you can see the voltages on internal nodes attempt to exceed the supplies. Differential amplifiers are also more easily understood after using the online tool to see the effects of common-mode and differential voltage inputs.

Other interactive design tools are used to help configure a device for your application. For example, the ADF4110 has four 24-bit registers. The register maps are included in the data sheet, and have also been converted to an online tool. These register configuration tools can be used to double-check your own calculations, saving valuable design time. The website has *register configuration assistants* for many of our ADCs, PLLs, and DDS products.

Free downloadable tools are also provided to simulate the performance of PLLs and ADCs. The PLL simulation tool assists in selecting a PLL and VCO, designing a loop filter, and predicting the system's performance. The ADC simulation is a virtual evaluation board. By applying a behavioral model of the ADC to a collection of characterization data, an engineer can quickly decide which ADC will have the best performance with a specific input signal.

In addition to the interactive design tools that are specific to individual products, we offer several useful utilities. These include *power dissipation*, to predict how hot a device will become, *conversion* between dBc and dBm, and a calculator showing the relationship between SNR, THD, and ENOB.

Wizards are the colloquial name for *analog design assistants*, tools that offer a more in-depth treatment of an application. Currently, wizards are available for designing active filters and photodiode circuits—and interfacing with bridge circuits. They are discussed is some detail below. Other links at the design center include sample code, a list of evaluation boards, and the DSP knowledgebase.

24 × 7 Amplifier Applications Support: Analog Wizards

"How do I find the best amplifier to use for a photodiode application?" "What is the best amplifier to use in a bridge-type application?" "What is the best amplifier to drive my ADC's input circuit?"

These are some of the typical questions an application engineer hears everyday. The Analog Wizard is a powerful tool that helps *you* answer questions of this kind.

This web-based tool—a collection of *analog design* assistants—offers circuit designs based on a user's specific requirements and includes a list of the suggested components. In the near future, extensions to this collection will enable the Wizard to walk a user through the elements of a complete signal chain. These web-based tools can be bookmarked to be the starting destination for ADI website visitors pursuing designs using our products.

The Analog Wizard is a timely response to the inexorably increasing need for design assistance. The shrinking number of analog experts in the world of systems design; the difficulty of finding a system designer who can understand all the parameters of analog and digital ICs; and the vast number of similar-but-different offerings within the product families of IC manufacturers have combined to create a need for this tool. This situation is further compounded by ever-shrinking product-design cycles, calling for ever-faster solutions.

Analog Devices, always aware of the needs for design assistance, has from the get-go helped designers by offering seminars, extensive publications—such as technical handbooks and in-depth data sheets—expert applications engineers, and—more recently—webcasts and web tools. Now, tools such as the Analog Wizard enable us to be at your beck and call, providing a high degree of applications support around the clock.

At first, the goal of the Analog Wizard was simply to narrow the choice to a few possible candidate amplifiers or other ICs to perform a specific function. But experience has shown that our role could not be limited to simply recommending suitable ICs; many users also requested that we specify the exact circuit configuration for their specific requirement. In one instance, we had to recommend an amplifier for a filter function, as well as to show the user how to implement the desired 3rd-order filter with a set of active and passive components. Thus, we needed to design and offer the complete circuit solution to the user. The Analog Wizard is designed to simplify the design task, providing many benefits to the user as discussed below.

The Wizard's operating approach is this: It asks the user a series of application-specific questions. Albeit not needing to know about the parameters of an amplifier or an ADC or micro-controller, the user *does* need to be able to specify exactly what is required. For example, the system designer needs to know the resolution requirements and available power supply levels in the system (whether single or dual, and their values). If at any point the user needs to understand the reasoning behind the questions asked, or is unclear about some of the terms used, the Wizard can help by providing links to definitions, articles, references, and examples of manufacturers' data sheets for explanations of the parameters and terms. The user can change the suggested default response to a question in order to see how it affects the solution.

Figure 2 shows an example of the types of questions asked about photovoltaic mode of a photodiode.

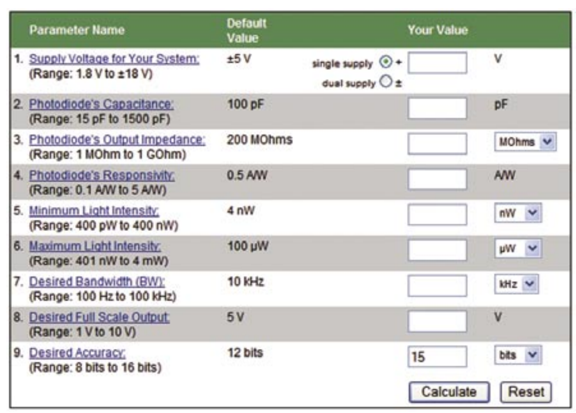

Figure 2. Typical Analog Wizard questions.

Based on the user's answers, the Analog Wizard calculates and defines its own search criteria for the Analog Devices *product database*. It then enters these search criteria into the product database, interrogates different part types that are suitable and relevant to the application, and suggests a number of them. The suggested parts are sorted based on required precision, temperature range, package options, and pricing. This listing and ranking might be presented in different ways, depending on the application. If the Wizard cannot meet all the imposed search criteria, it will still provide a close suggestion—with the failed parameters highlighted in red—and will state a good reason for the failure. Figure 3 shows a typical amplifier listing called up by a specific task.

In addition, the wizard allows the user to enter and compare a generic part number (for a part that may already be on hand) against the suggested parts. Further, the user can link to the product page of the selected device from the solution page.

Amplifier Part	1K Price [OEM US$]	Available Packages	Temperature Range	Signal to Noise Ratio (Calculated) [dB]	Signal to Noise Ratio (Theoretical) [dB]	View Amplifier Solution
1. AD8571 BEST FIT	$1.00	SOIC, SOP	-40 to +125 Deg C	93.24	92.06	View Amplifier Solution
2. AD8065	$1.59	SOIC, SOT	-40 to +85 Deg C	90.60	92.06	View Amplifier Solution
3. AD8531	$0.27	SC70, SOIC, SOT	-40 to +85 Deg C	94.83	92.06	View Amplifier Solution
4. AD8033	$1.19	SC70, SOIC	-40 to +85 Deg C	89.26	92.06	View Amplifier Solution
5. AD8601	$0.29	SOT	-40 to +125 Deg C	94.90	92.06	View Amplifier Solution

To compare a specific ADI part with the recommended parts, please type in the ADI part number and click the "Add to Table" button.

Add to Table

Figure 3. Suggested amplifiers for a photodiode application.

Besides the suggested ICs (usually up to 5 different device types), the user also receives a *bill of material* (BOM) and a circuit schematic representing the designed solution, as shown in Figure 4.

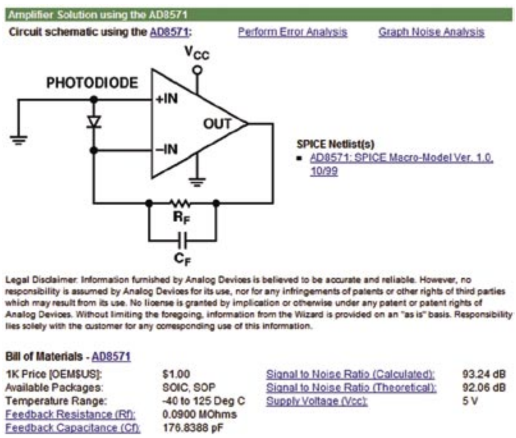

Figure 4. Typical solution circuit with bill of material.

The Analog Wizard provides many more benefits. It will provide the PSpice model for ADI's IC device when available. It will also generate the circuit solution's *netlist*. Users can save or cut-and-paste this information into their PSpice model environment for further analysis and evaluation in a theoretical world.

The BOM shows the theoretical values of the passive components used in the circuit. Finding components in the real world that match the theoretical values will be very costly and time consuming, if not impossible, so the Analog Wizard allows the user to access the *error analysis tool*. In this environment, the user can introduce tolerances for resistance and capacitance values as shown in the schematic of Figure 5 and perform further error analysis on the suggested configuration.

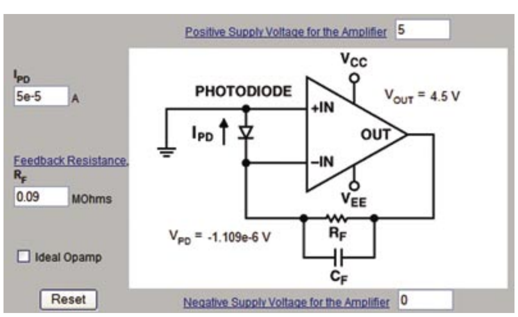

Figure 5. Error analysis tool.

The maximum benefits from the wizard depend on the application at hand. For instance, in the case of the Photodiode Wizard, the user can look at the noise spectrum of the solution suggested. In addition, it provides the theoretical and actual *signal-to-noise ratio* (SNR). Figure 6 shows a typical noise spectrum for the circuit shown in Figure 4.

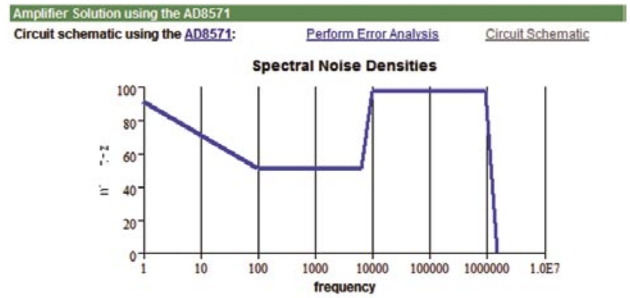

Figure 6. Typical noise spectrum for a photodiode application.

To simplify the task of getting user feedback, acquiring data on customer satisfaction, and providing any needed support, there are links for feedback and to request customer support on all pages of the Wizard.

The photovoltaic mode of photodiode application was picked for development due to its popularity and the number of questions asked by users. This could be followed in due course by development of a wizard to handle *photoconductive* circuit applications. The second module of Analog Wizard was the Bridge Wizard. The third module released was the Filter Wizard. The future of Analog Wizards looks very promising. There are many other persistently recurring topics, such as A/D converter drive amplifiers, currently handled by our application engineers that could be dealt with in mutually beneficial fashion by these *design-assistant*, or "Wizard", modules. Just to contemplate a signal chain, such as that shown in Figure 1, is to get a feeling for the opportunities in product and system design.

Before we leave the subject, we must return to real-world considerations and emphasize that these design *assistants* are just *that*. They can speed up the process and relieve the design engineer or technician of the arduous work of routine calculations—but they will never relieve the designer of the burden of *engineering judgement*. The list of real-world considerations beyond those handled by these simple "Wizards" is impressive: For example, the ever-increasing environment of RF energy as a source of interference must be dealt with; considerations of layout, grounding, strays, and parasitics will always be with us; and questions relating to the ambient physical environment, as it affects—and is affected by—the design always require attention.

Nevertheless, these tireless design assistants exist on the web to provide applications support around the clock. They are a resource that provides many benefits to designers. They are self-guiding and helpful; they ask a series of questions in familar application-oriented language (rather than the language of IC parameters); they are helpful in the part selection process. They can offer the elements of a complete solution, including, as shown, a bill of materials and Pspice netlist; and they provide links to further error analysis and evaluation tools and materials—and ultimately to human assistance. Yet users can explore the possibilities at their own convenience, with powerful help toward designing the best solution using off-the-shelf parts.