Getting Started with TINA-TI™

This quick-start user's guide presents an overview of TINA-TI™, a powerful circuit design and simulation tool. TINA-TI is ideal for designing, testing, and troubleshooting a broad variety of basic and advanced circuits, including complex architectures, without any node or number of device limitations. This document is intended to help new TINA-TI users start creating circuit simulations using the fundamental features of TINA-TI software in the shortest possible time.

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1 Overview

Texas Instruments has teamed up with DesignSoft, Inc. to provide our customers with TINA-TI, a powerful circuit simulation tool that is well-suited for simulating analog and switched-mode power supply (SMPS) circuits. The tool is ideal for helping designers and engineers to develop and test circuit ideas.

TI selected the TINA™ simulation software over other SPICE-based simulators for its combination of powerful analysis capabilities, simple and intuitive graphics-based interface, and ease of use, allowing you to be up and running in minimal time. If you are familiar with another SPICE simulator, adapting to TINA-TI should be an easy and straightforward transition. Although TINA-TI is a limited version of more powerful DesignSoft simulation products, it easily handles surprisingly complex circuits.

Texas Instruments does not warrant or support any DesignSoft product. TINA-TI is a software program developed by both TI and DesignSoft. For more information about DesignSoft, visit the DesignSoft website at www.designsoftware.com.

2 Schematic Editor

You can download TINA-TI from the TINA-TI webpage, as shown in Figure 1. Alternatively, it is available through the TI home page at www.ti.com; enter ***TINA*** in the keyword search field to display a summary of TINA-TI related information. Selecting the first result takes you to the TINA-TI webpage.

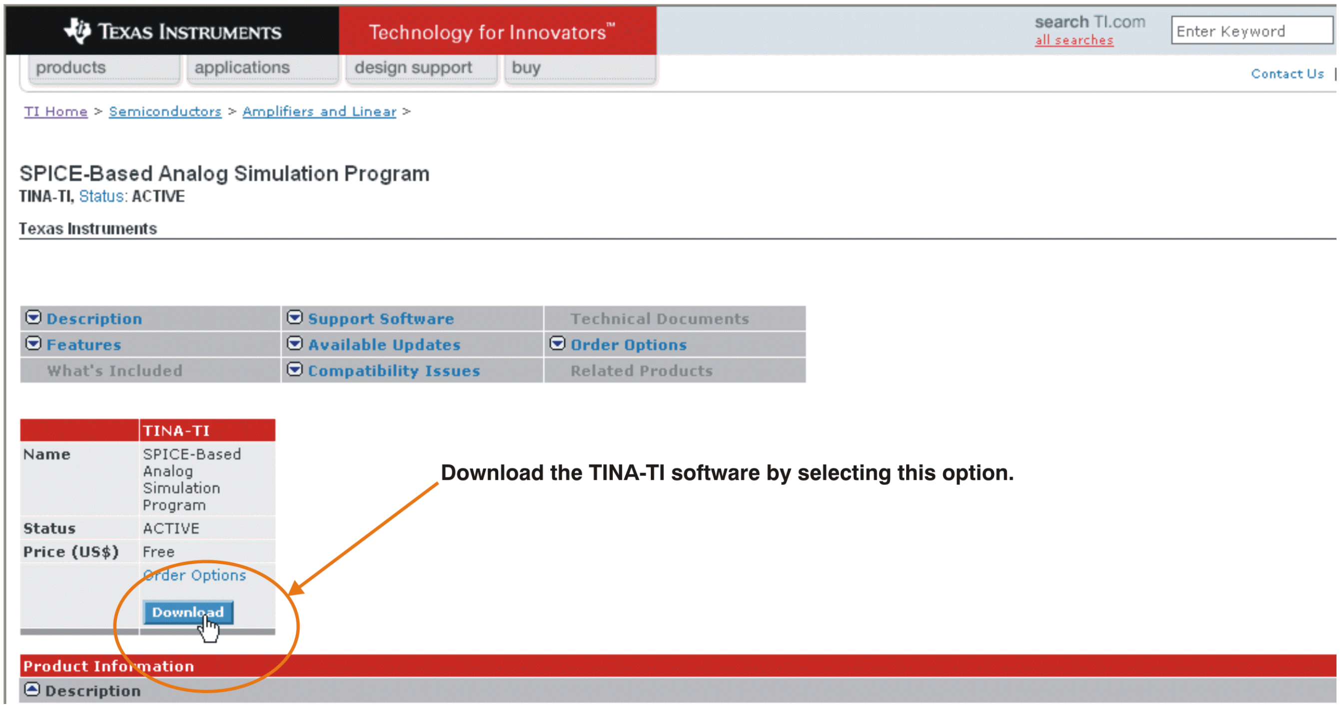

Figure 1. Downloading TINA-TI

The minimum hardware and software requirements for the currently released TINA-TI version are:

- IBM PC-compatible computer running Microsoft Windows® 98/ME/NT/2000/XP
- Pentium or equivalent processor
- 64MB of RAM
- Hard disk drive with at least 100MB free space
- Mouse
- VGA adapter card and monitor

Once the software is downloaded to your system, select the program through the Windows Start menu or click on the TINA-TI icon on your desktop that was created during the installation. The first screen appears as shown in Figure 2.

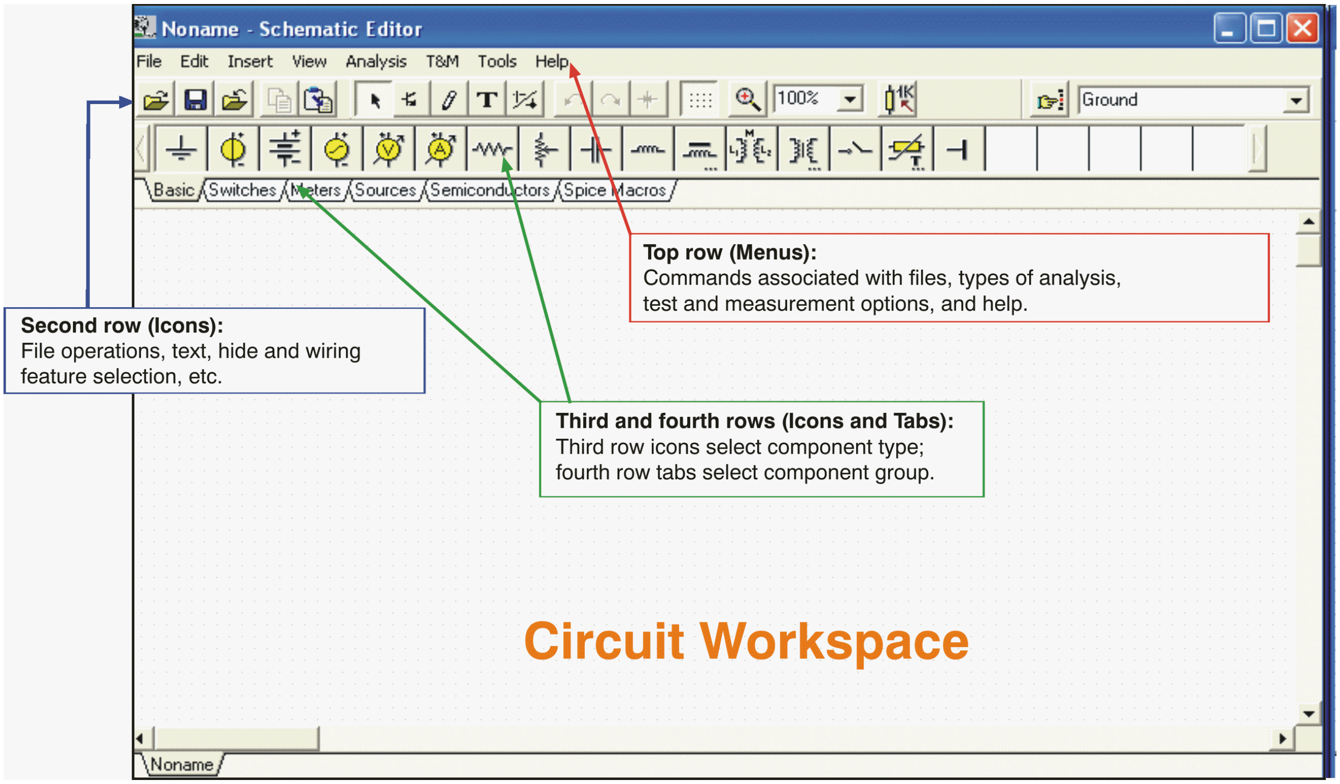

Figure 2. TINA-TI Schematic Editor Display

Figure 2 shows the schematic editor layout. The empty workspace on the sheet is the design window where you build the test circuit. Below the Schematic Editor title bar is an operational menu row with selections such as file operations, analytical operations, test and measurement equipment selection, etc. Located just below the menu row is a row of icons associated with different file and TINA tasks. The final row of icons allows you to select a specific component group. These component groups contain basic passive components, semiconductors, and even sophisticated device macromodels. These groups are accessed to build the circuit schematic.

3 Building a Circuit with TINA-TI

To illustrate how easy it is to use TINA-TI, we will build an analog circuit and demonstrate some of the circuit analysis capabilities.

For this example, a high-output, 1kHz sine wave oscillator circuit is selected. A search through a circuit application handbook provides a number of op amp-based designs. We will build and simulate a Wien-bridge oscillator with amplitude stabilization using the software. A Texas Instruments' OPA743 12V CMOS op amp is selected for the circuit application. This amplifier is well-suited for this design, and provides very good dc and ac performance. It operates with supplies of 3.5V to 12V; our example requires ±5V (10V).

Select the *Spice Macros* tab (see Figure 3, step 1) and then the op amp symbol (step 2) to access the OPA743 macromodel. When the op amp model list appears, scroll down and click on the OPA743 (step 3). Then click *OK*. The op amp symbol appears in the circuit workspace. With the mouse, drag the symbol into position (step 4). It is locked into position on the circuit workspace by clicking the left mouse button.

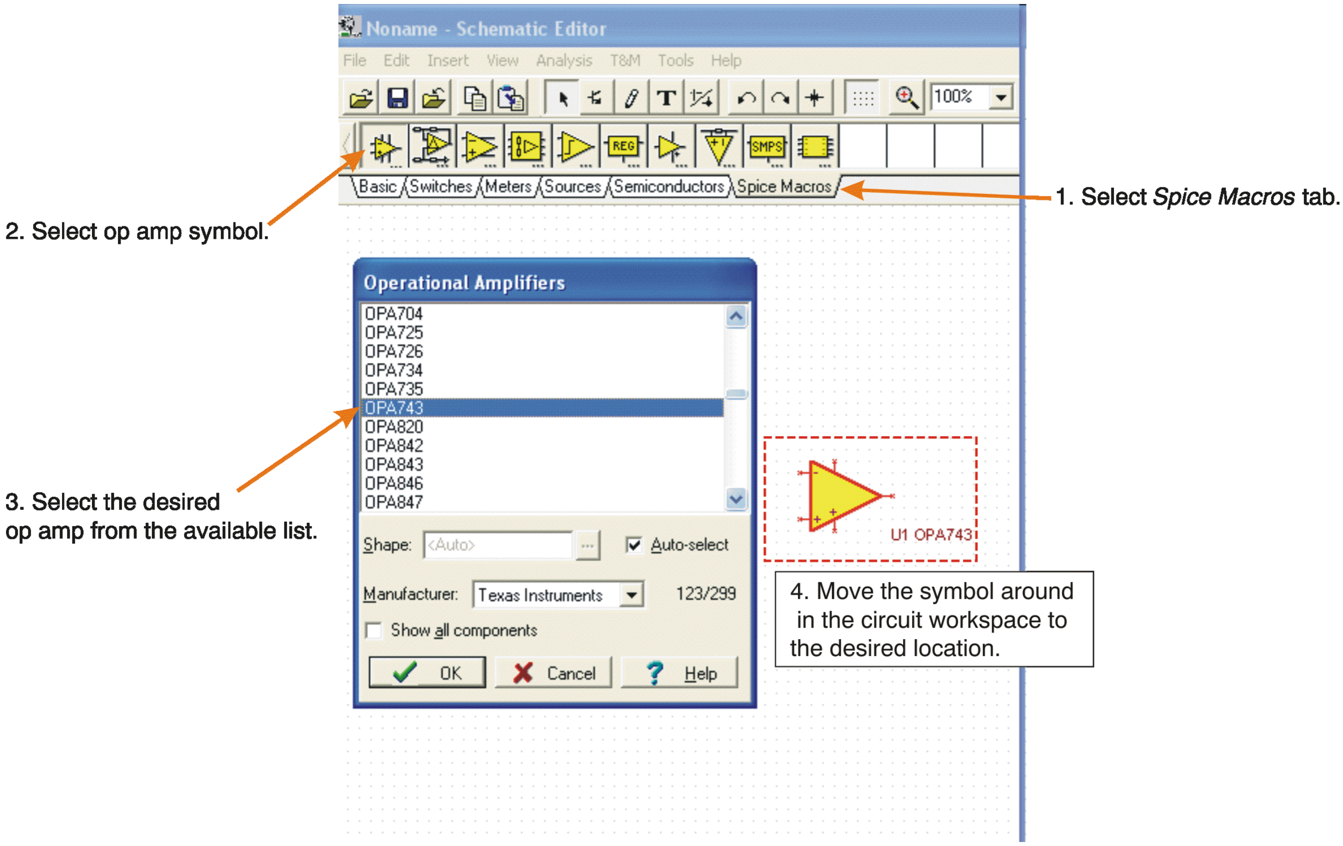

Figure 3. Building a Circuit with TINA-TI

Other op amp models may be selected using the *Insert->Macro...* menu. Additionally, macros and a wide variety of pre-built analog and SMPS circuits can be accessed through the *Insert* menu. (*Insert->Macro...TinaTI_7.0->Examples*).

3.1 Adding Passive and Active Components

Component selection is easily accomplished by clicking on a component group from the lower row of tabs: Basic, Switches, Meters, and so forth. These tabs provide a wide variety of passive components, sources, meters, relays, semiconductors, and the previously-mentioned circuit macros. Click on the schematic symbol for a particular component and drag it into position in the circuit workspace. A left mouse button click locks it into place.

In our example, shown in Figure 4, we select a resistor from the *Basic* tab group (step 1 and step 2), then position it next to the op amp symbol. TINA-TI designates this resistor as **R1**. The initial value of R1 is 1kΩ, but this value can be changed as needed. A double-click with the left mouse button on the R1 symbol produces the associated component table (step 3).

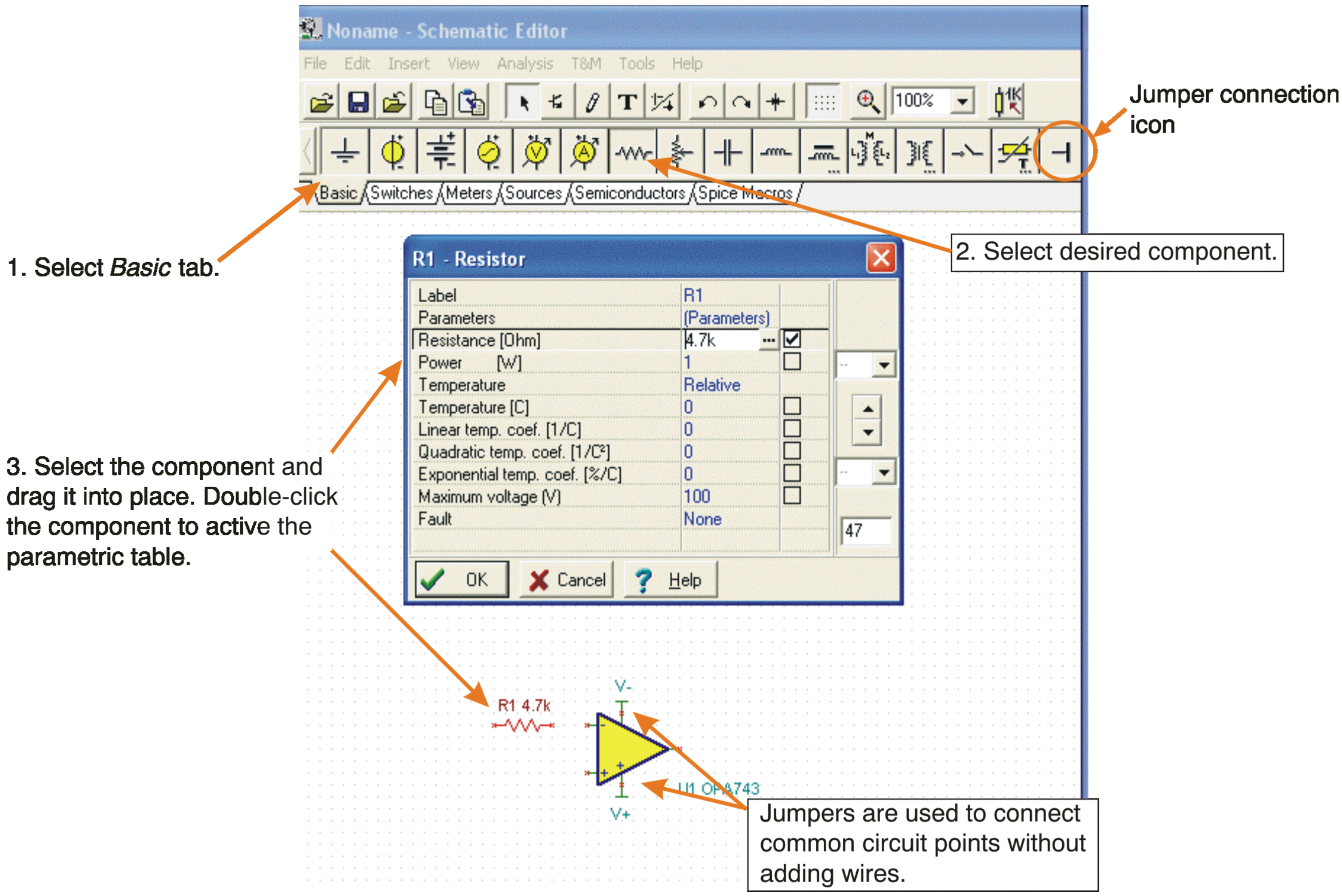

Figure 4. Active and Passive Component Selection

The resistor value and other component characteristics may be altered by selecting the individual parameter boxes and changing the respective values. Select the component parameter box and highlight the value you wish to change. Enter a new value by typing over the value that is shown. In Figure 4, for example, the value for R1 has been changed from 1k to 4.7k for this circuit. Once you have finished setting the parameters, click **OK** to close the table. Similar parametric tables are available for passive devices, sources, semiconductors, and other component types.

A handy component that is displayed in the Basic group is the jumper, as shown in Figure 4. It looks like a sideways letter *T*. The jumper may be used to connect similar, related circuit functions such as V+, V–, or any other circuit point that has multiple connections. Using the jumper reduces wiring clutter. Note that common jumpers must be labeled with the same label name for TINA-TI to connect them together.

3.2 Arranging and Wiring Components

Once all components are selected and properly positioned, they can be wired together. Each component has nodes where circuit connections are needed. TINA displays these nodes with a small red ***x***. (The ***x*** looks more like two small lines at the wiring node than the alpha character.) Wiring components to each other is easily done by placing the mouse pointer over a node connection and holding the left mouse button down. A wire is drawn as the mouse is moved along the circuit space grid. Release the mouse button when the wire reaches the intended end connection point. Figure 5 illustrates the TINA-TI software wiring function.

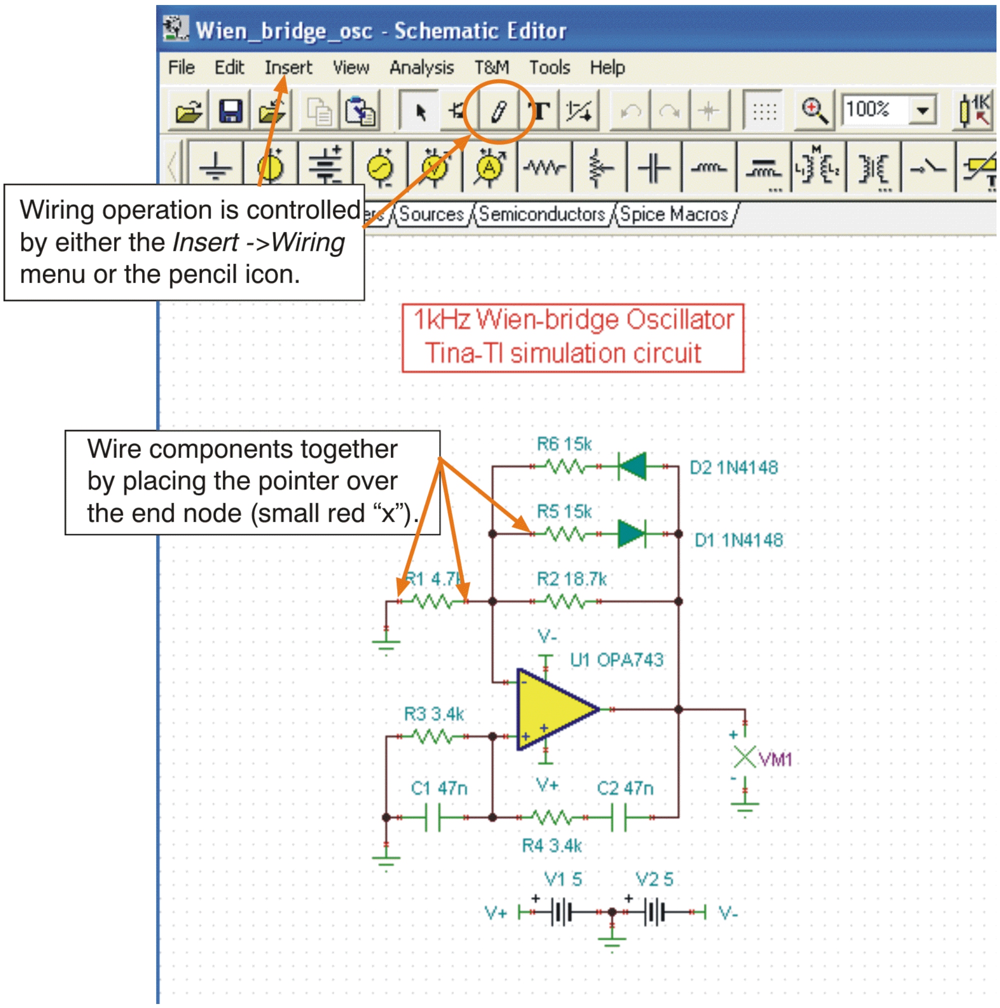

Figure 5. Wiring Components Together

The wiring function also may be accessed from the *Insert* menu, or the icon that looks like a small pencil.

4 Analysis Capabilities

When the circuit schematic entry is complete, the circuit is nearly ready for simulation. The analysis process begins by selecting the *Analysis* menu. A list of different types of analyses—such as ac, dc, transient, or noise—appears. Highlight any one of these evaluations to access additional options and selections.

The first option under the *Analysis* menu is an Error Rules Check (ERC). Selecting this feature runs this check on the circuit; a pop-up window then lists any circuit errors. If an error is listed in the window, clicking on that error line highlights the error point in the schematic. The error window also lists other types of circuit errors that are found during the analysis.

Even if the ERC is not selected, TINA automatically performs a check at the start of a simulation.

Upon selecting one type of analysis to perform, another window appears that displays different setting selections that are associated with that particular analysis. Nominal settings are initially provided; these parameters may be set as needed for the desired output.

Once all of the selections are made, click ***OK*** to begin the analysis. The first analysis performed on a circuit is generally a dc analysis. This test provides a reality check so that normal dc operating conditions can be verified. The TINA-TI DC Analysis function can be set to calculate nodal voltages, provide a table of dc voltage and current results, generate a dc sweep of the circuit, or perform a temperature analysis. The temperature analysis works in combination with the *Analysis* > *Mode* > temperature-stepping selections.

4.1 DC Analysis

Follow these steps (illustrated in Figure 6) to perform a dc analysis.

1. Click on the *Analysis* menu.
2. Select *DC Analysis*.
3. Click on *Table of DC Results*. The Voltages/Currents table appears.
4. Use the mouse pointer as a probe to test the circuit nodes.

The probed node and measured value are displayed in red in the Voltages/Currents table, as shown in Figure 6.

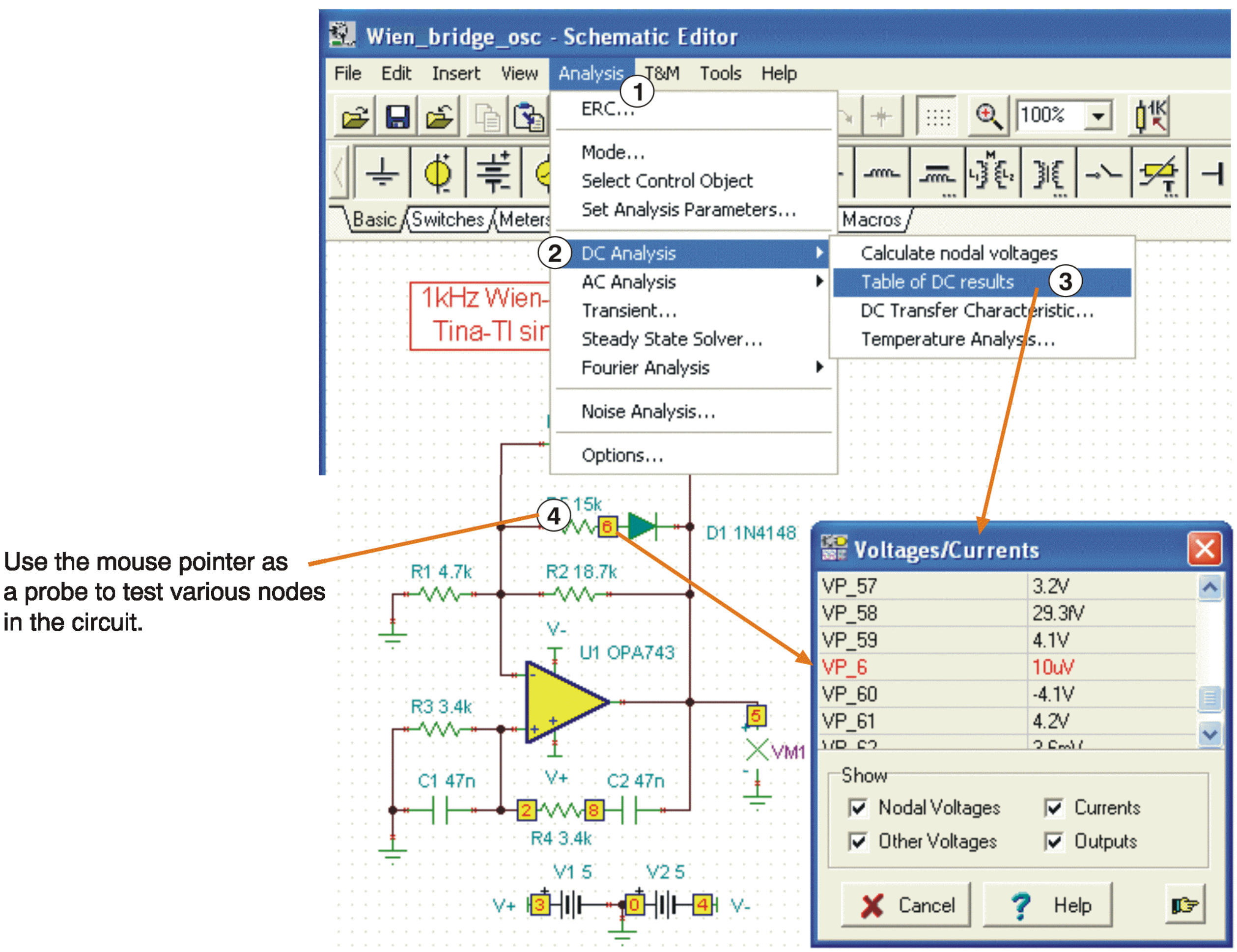

Figure 6. DC Analysis with Voltages/Currents Table Displayed

4.2 Transient Analysis

Sophisticated ac frequency and time domain simulations may also be performed. Use the Analysis function to access the different choices. A traditional ac transfer characteristic plot of gain and phase versus frequency may be selected, as well as transient, Fourier or noise analyses. The example shown in Figure 7 is a transient analysis performed on the example Wien-bridge oscillator circuit. The simulation transient analysis result is also shown in Figure 7. It illustrates the Wien-bridge oscillator startup and steady-state performance. The display in the actual window may be edited with axis labeling, scales, background grid color, and so forth, all set as desired by the individual user.

Follow these steps (marked in Figure 7) to perform a transient analysis.

1. Click on the *Analysis* menu.
2. Select *Transient*.
3. The Transient Analysis dialog box appears. Enter start and end times, and other parameters as desired.
4. Click *OK* to run the analysis.

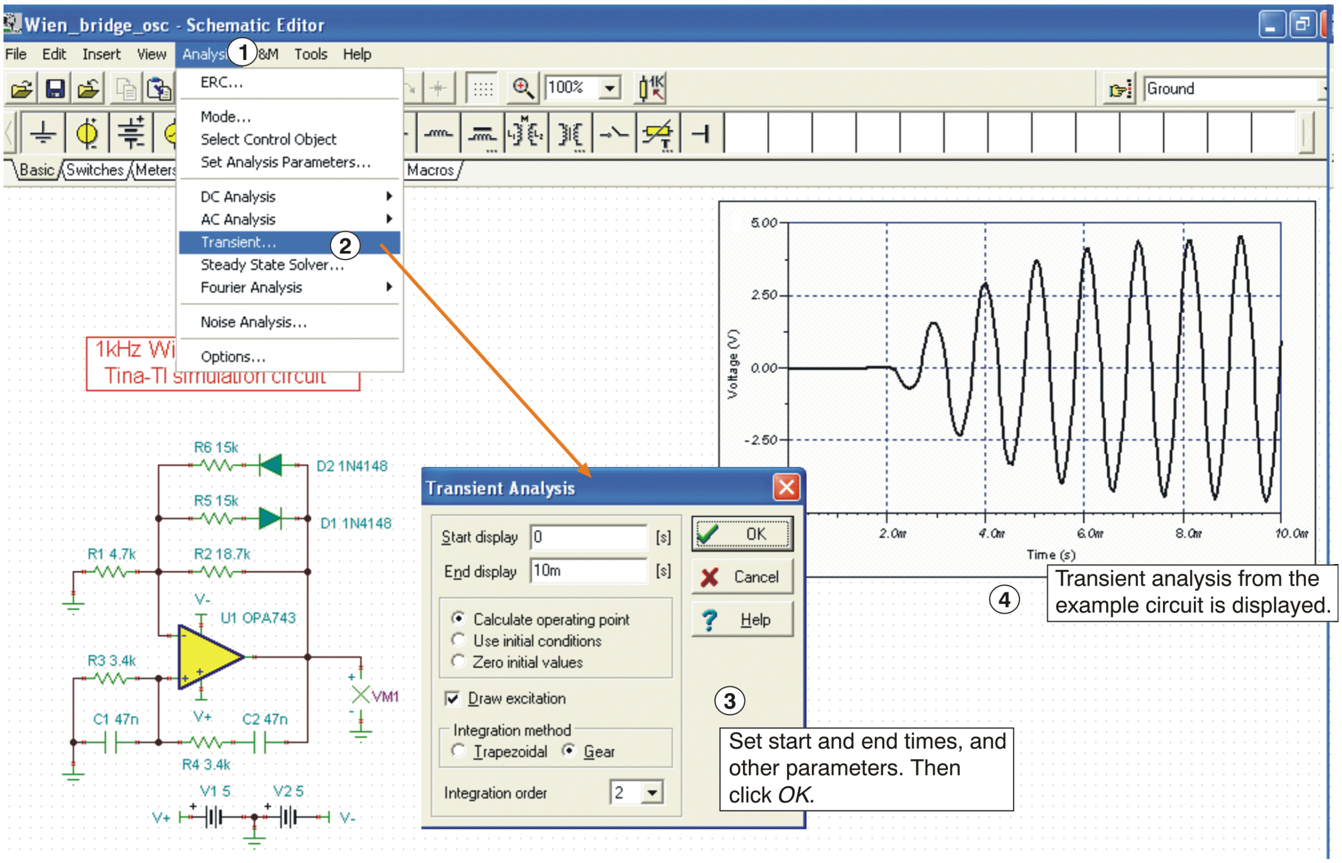

Figure 7. Additional TINA Analysis Capabilities

5 Test and Measurement

The TINA-TI software generates post-simulation results in tables and plots, depending on the type of analysis performed. Additionally, the software can be placed in a pseudo-real-time simulation mode where virtual instruments can be used to observe the output(s) while the circuit is operating.

For example, Figure 8 shows a virtual oscilloscope that is used to observe the steady-state output of the Wien-bridge oscillator circuit. In the same way, a virtual signal analyzer can be used together with an amplifier circuit so that the harmonic performance of a simulation can be observed. To access the virtual oscilloscope, select *T&M* (step 1 in Figure 8), and then *Oscilloscope* (step 2). Place the cursor at the output of the simulated circuit, and adjust the controls in the virtual oscilloscope dialog box as needed (step 3).

The T&M selection options also include a virtual ac/dc multimeter, function generator, and an X-Y recorder. The function generator may be adjusted in combination with a virtual oscilloscope or analyzer.

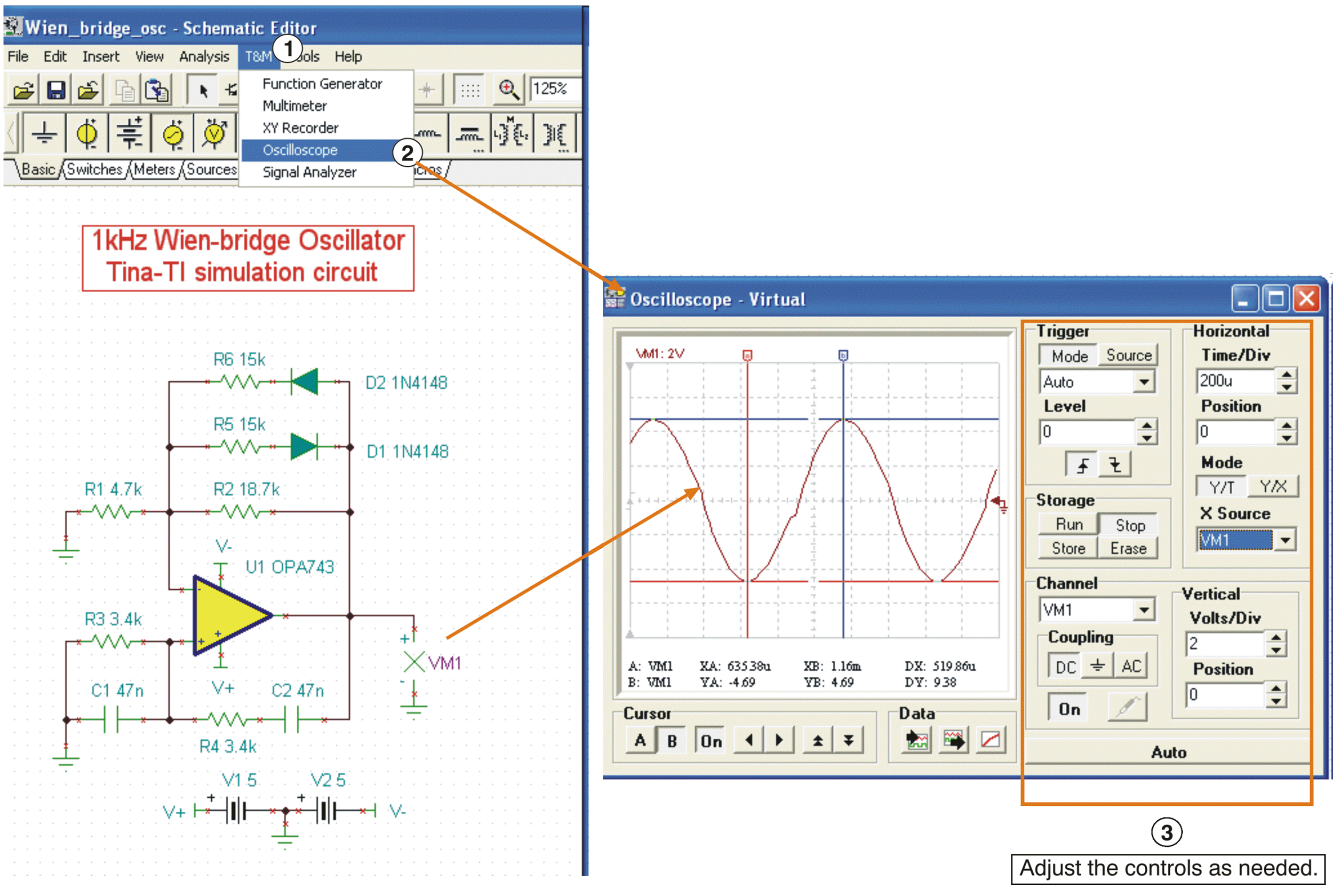

Figure 8. Virtual Instrumentation Testing

6 Additional Assistance

TINA-TI has many more features that can be explored. As you become more comfortable with the simulation software, you will be able to take advantage of these capabilities to build circuits more rapidly, perform more sophisticated simulations, and optimize the output information for a variety of needs.

The software also offers on-screen contextual help, and displays mouse-over descriptions for many icons and areas of the workspace, as shown in Figure 9. If you need additional assistance with a particular analysis, or help with setting the active component parameters, detailed help documentation is available. Click on the *Help* menu to access information associated with circuit analysis, active components, and so forth. Further assistance for specific TINA-TI application simulations is available by contacting your local TI technical representative.

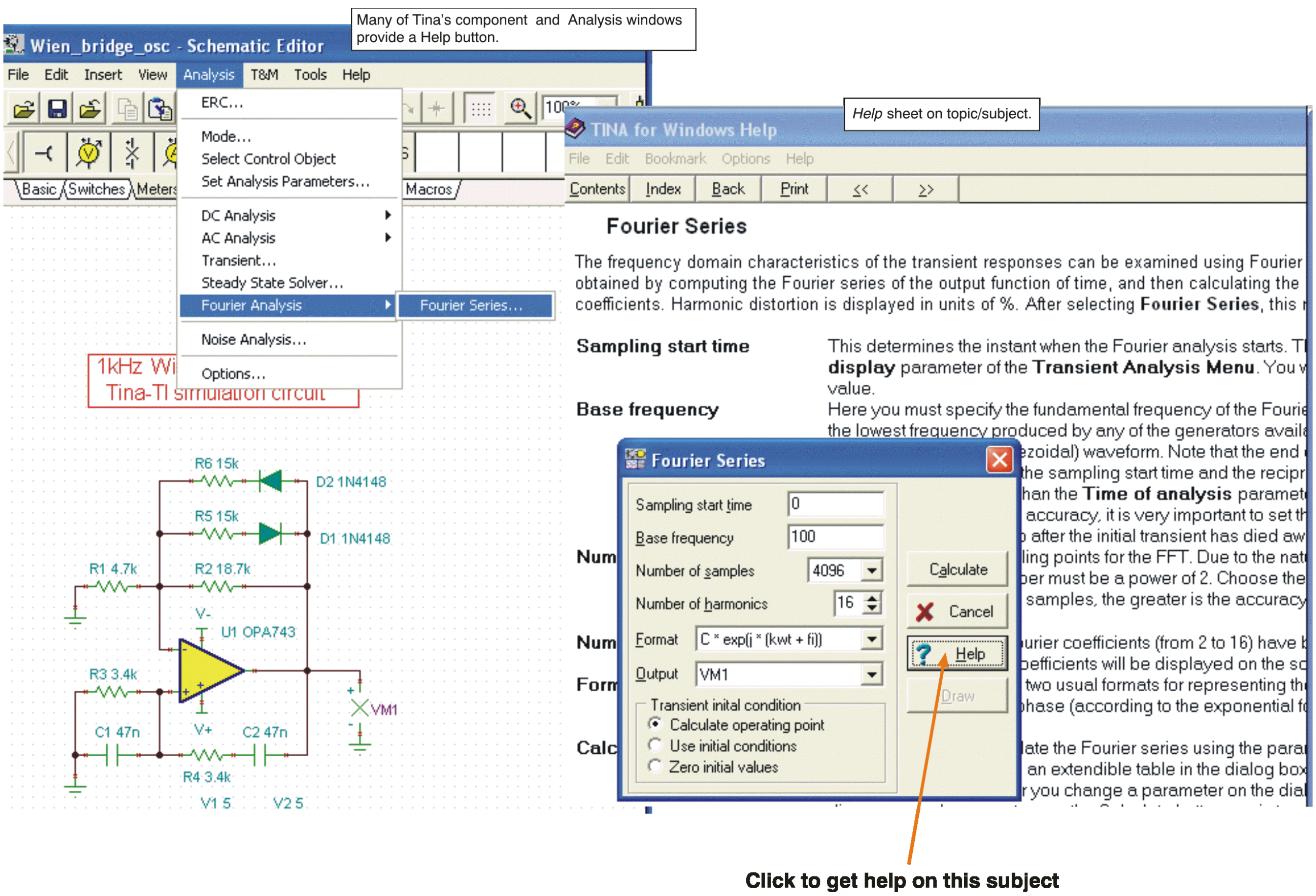

Figure 9. Contextual Help in TINA-TI

Note: Texas Instruments does not offer support for TINA software. Contact DesignSoft if you have questions or need assistance with general TINA software issues.
