Quick Start Guide

Simulating AC/DC Controllers with NL5 Simulation Software

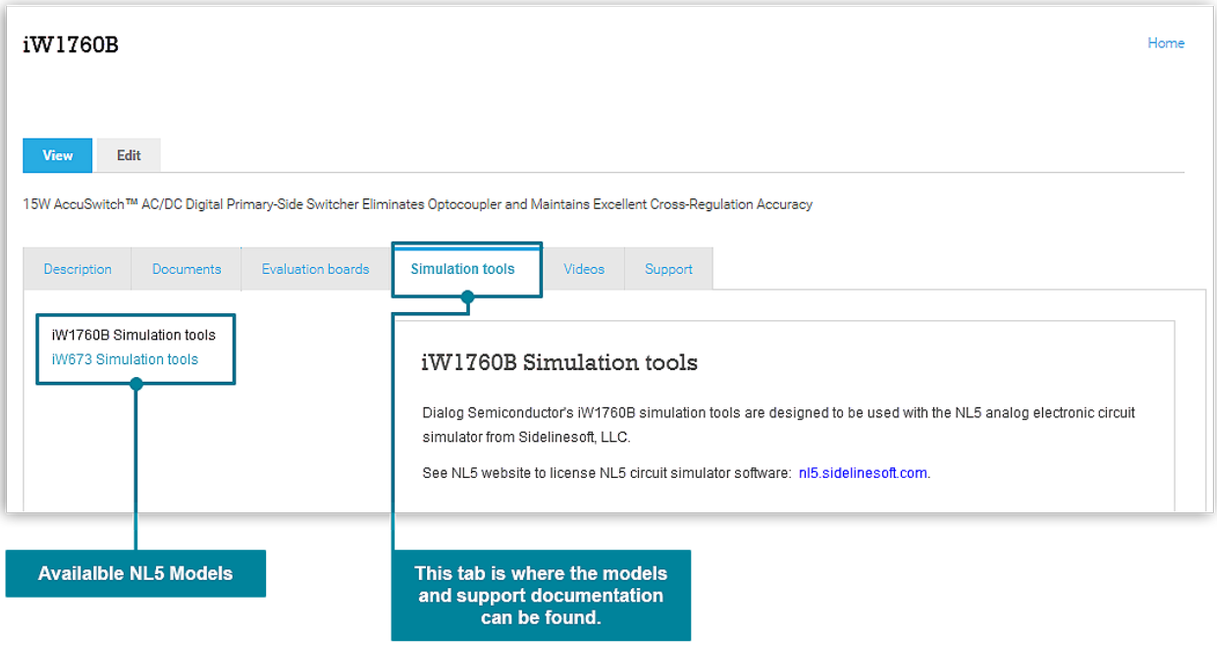
Dialog Semiconductor offers models to design and simulate AC/DC offline converters prior to prototyping. These models use NL5 simulation software from Sidelinesoft, LLC., to enable analog components and digital DLL files to be combined and simulated together for more accurate results.

This quick start guide provides quick steps to get the program running, load a model and add/remove/modify components around the main model.

Step 1: Download NL5 Software from http://nl5.sidelinesoft.com. IMPORTANT NOTE: Dialog's models are compatible with the 32-bit versions of the NL5 software (v2.x). Please be sure to download the 32-bit version to use with the Dialog models.

Step 2: Login or Sign-up for access to Dialog's customer support site at https://support.dialog-semiconductor.com

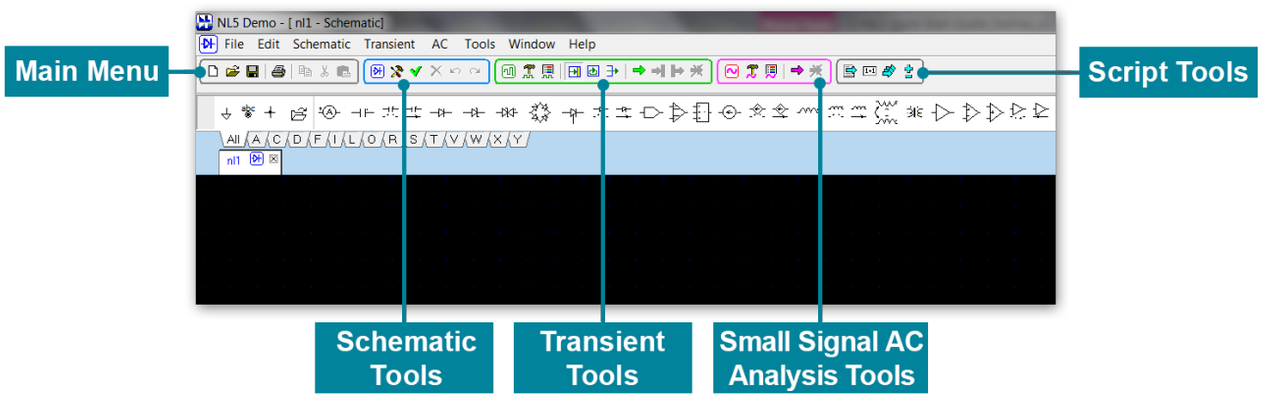
Step 3: Find and download models under the "Simulation Tools" tab for each product.



Dialog Semiconductor's Customer Support Site

Step 4: Launch NL5

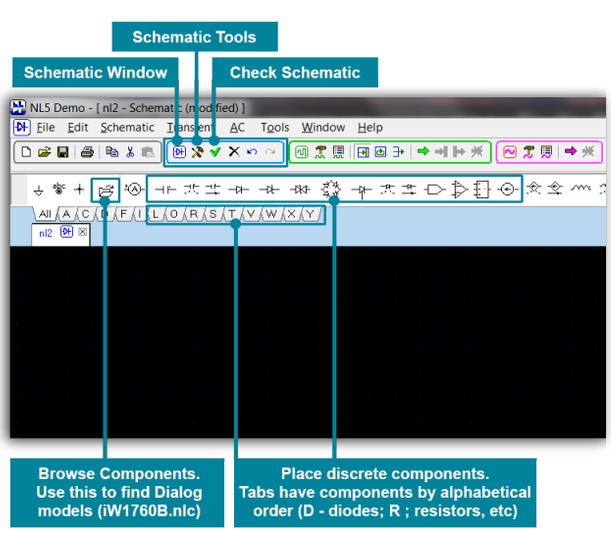
1. NL5 Main Navigation Menu



NL5 contains five sets of quick access buttons on the main tool bar, which is where most of the work will be done when drawing schematics and simulating. The first button on each set of tools opens its corresponding window in the software and enables the features associated with that set of tools.

2. Schematic

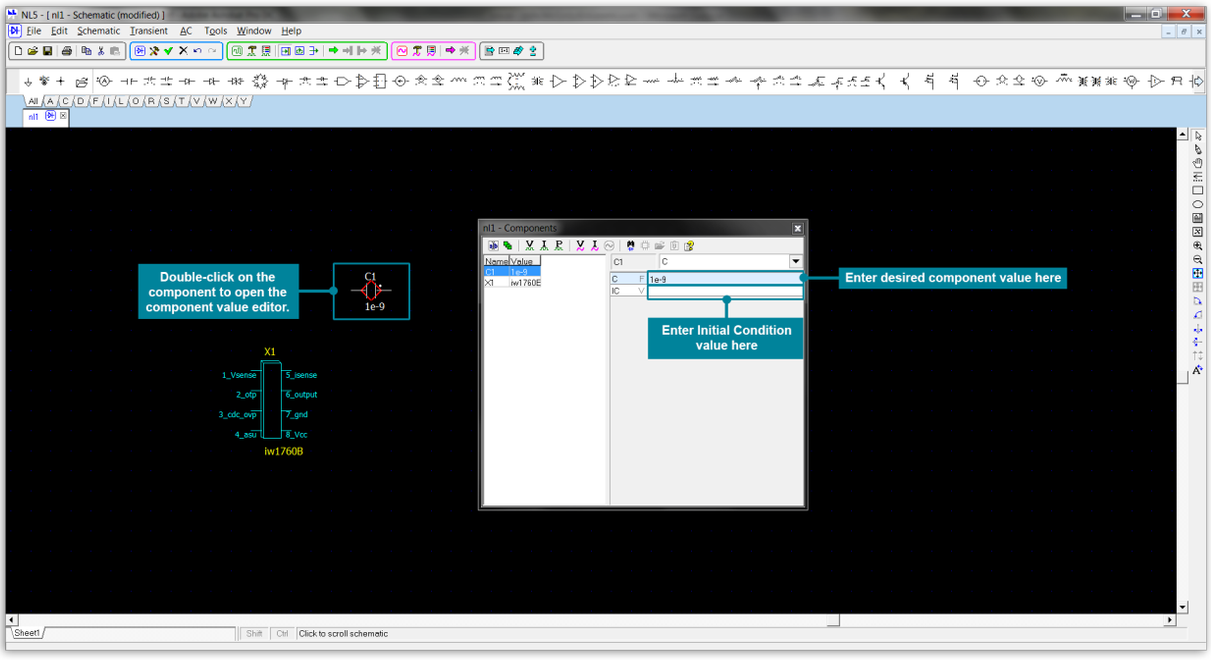
Place a component by double-clicking on a component shown on the toolbar or by browsing for a component in a local folder.



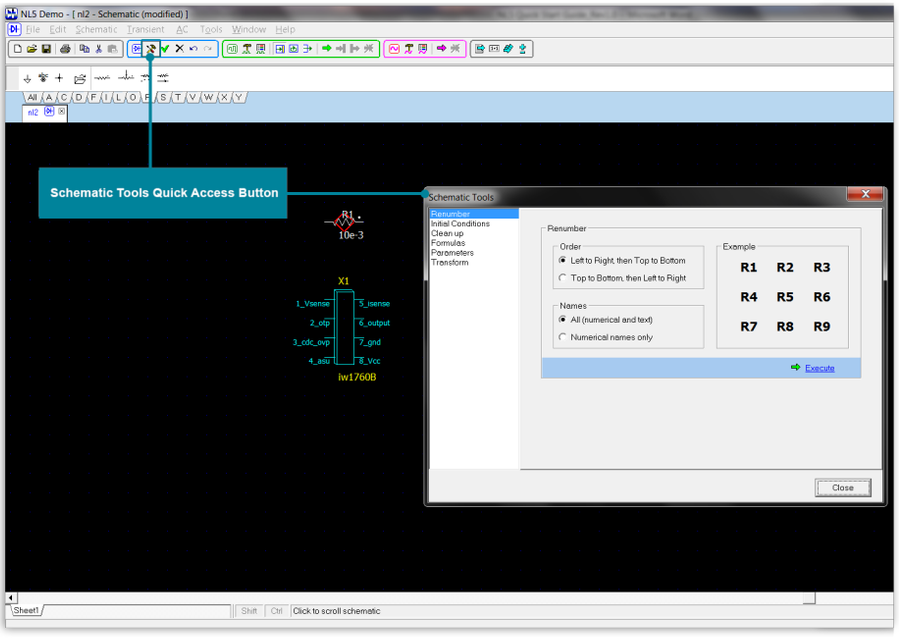
Once placed, double-clicking on the component value allows you to modify it. For a 10kΩ resistor value, the software will recognize the value written in the following ways: 10000; 10e3; 1e4; 10k. Likewise for capacitors and inductors, values can be written at 10e-6 or 10u and the software correctly places the desired value.

NL5 allows the user to establish an Initial Condition (IC) for some components, which expedites simulation results. For example, a capacitor that needs to slowly charge up to a specific threshold voltage can be given a voltage value as an initial condition. This helps reduce the simulation time that would normally occur waiting for that capacitor to reach this initial condition.

2.1. Modifying Discrete Component Values/Labels

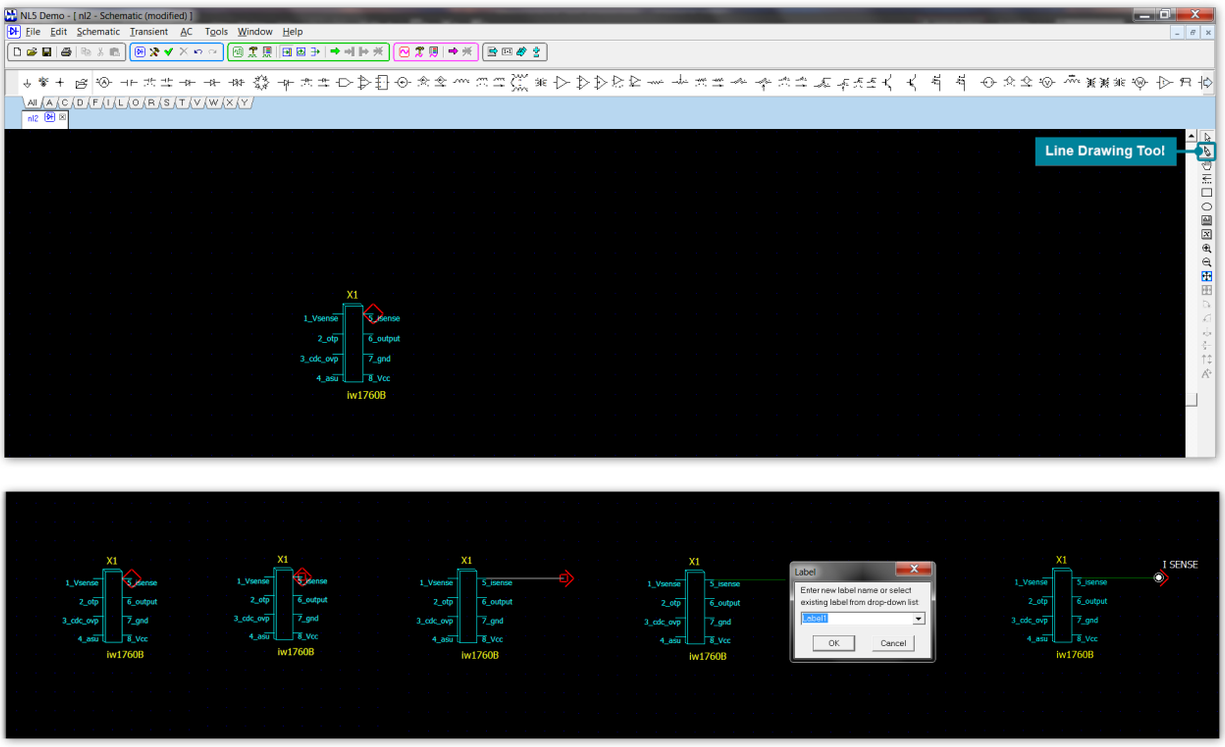


Components are labeled automatically, but using the “Schematic Tools” button, the schematic can be cleaned up and re-numbered automatically once all components have been placed.

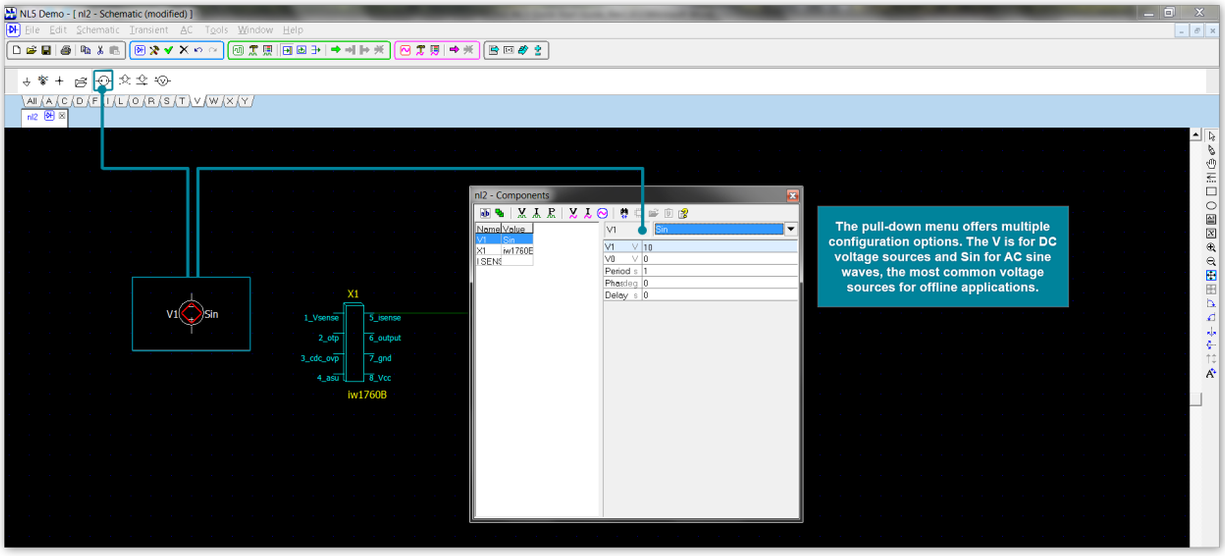


2.2. Drawing wires

Using either the vertical tool bar on the right and selecting the drawing button, or by positioning the red arrow over the point where you want to begin the drawing, press the space bar and then use the arrow keys to draw a wire. When finished, either press the space bar or press enter if you want to label that node. Any label can then be viewed on the transient screen while running simulations.

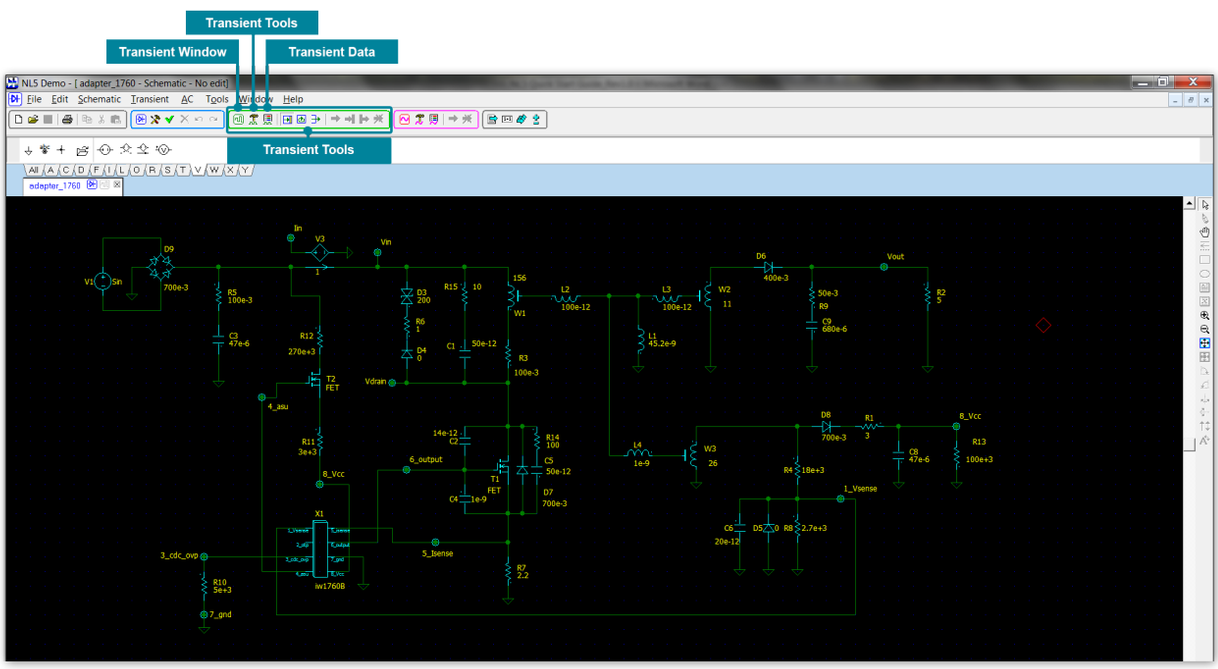


Voltage and current sources are added and configured similar to passive components.

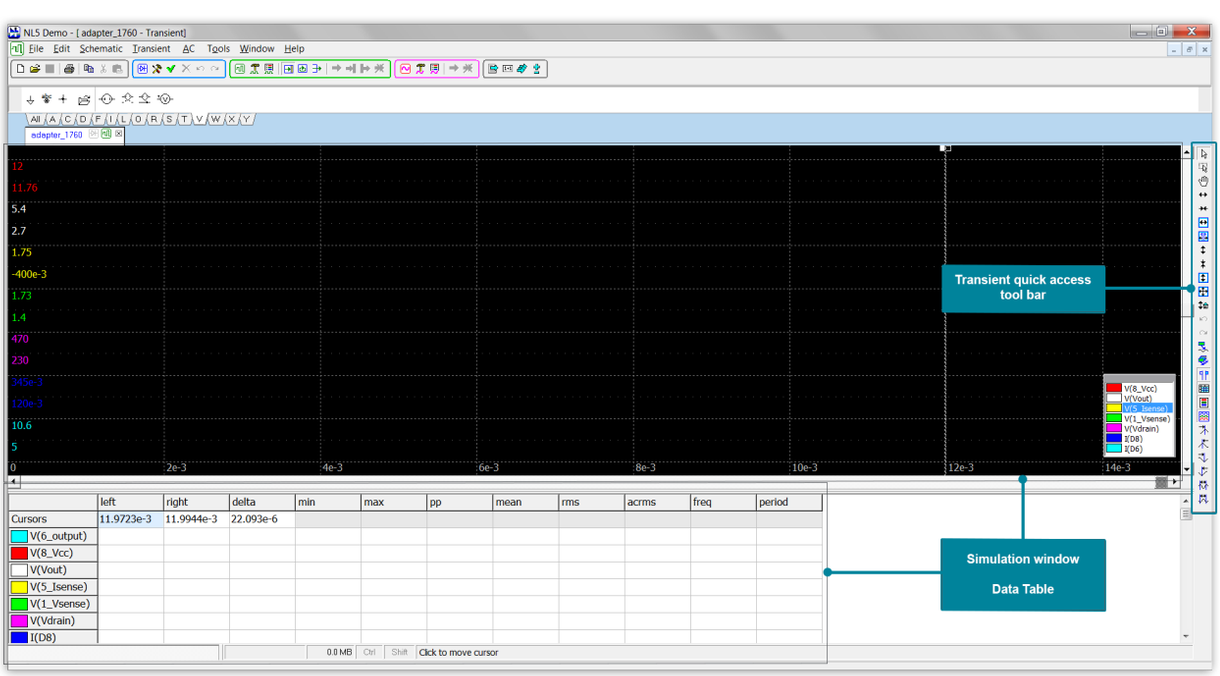


3. Transient Menu

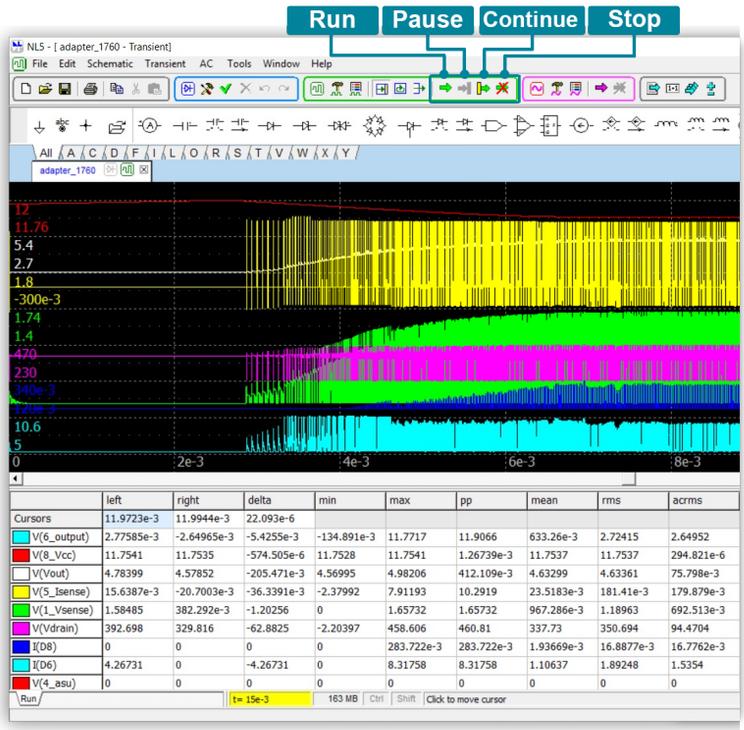
Once the schematic is drawn and all values configured, the transient, or simulation, function can be used. The transient window can be opened using the quick-access button.



The transient screen opens up with two work areas, the simulation area and data table. The table can be removed from the visible area via the quick access button on the vertical menu to the right of the screen. The table shows the data points on the transient corresponding to the location of the cursors, along with some basic math functions.



3.1. Basic transient controls



	left	right	delta	min	max	pp	mean	rms	acrms
Cursors	11.9723e-3	11.9944e-3	22.093e-6						
V(6_output)	2.77585e-3	-2.64965e-3	-5.4255e-3	-134.891e-3	11.7717	11.9066	633.26e-3	2.72415	2.64952
V(8_Vcc)	11.7541	11.7535	-574.505e-6	11.7528	11.7541	1.26739e-3	11.7537	11.7537	294.821e-6
V(Vout)	4.78399	4.57852	-205.471e-3	4.56995	4.98206	412.109e-3	4.63299	4.63361	75.798e-3
V(5_Isense)	15.6387e-3	-20.7003e-3	-36.3391e-3	-2.37992	7.91193	10.2919	23.5183e-3	181.41e-3	179.879e-3
V(1_Vsense)	1.58485	382.292e-3	-1.20256	0	1.65732	1.65732	967.286e-3	1.18963	692.513e-3
V(Vdrain)	392.698	329.816	-62.8825	-2.20397	458.606	460.81	337.73	350.694	94.4704
I(D8)	0	0	0	0	283.722e-3	283.722e-3	1.93669e-3	16.8877e-3	16.7762e-3
I(D6)	4.26731	0	-4.26731	0	8.31758	8.31758	1.10637	1.89248	1.5354
V(4_asu)	0	0	0	0	0	0	0	0	0

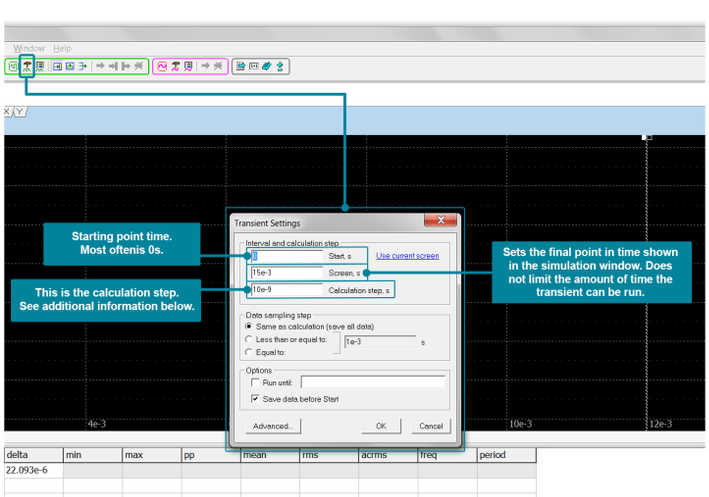
- **Run:** starts the simulation.
- **Pause:** pauses the simulation and allows the simulation to continue from that exact point in time.
- **Continue:** continues the simulation from that exact point in time, works with either a paused transient or when the transient reaches the end of the visible screen.
- **Stop:** stops the simulation completely.

IMPORTANT: At times, you may need to stop the simulation momentarily and make adjustments to the transient configuration and then continue the simulation. You must use the **PAUSE/CONTINUE** buttons to hold the simulation at its exact point in time. Once you click the **STOP** button, the simulation will restart from time zero.

3.2. Transient configuration

Transient settings must be configured for each simulation in order to obtain relevant data. To obtain accurate results, it is important to understand the calculation step in more detail.

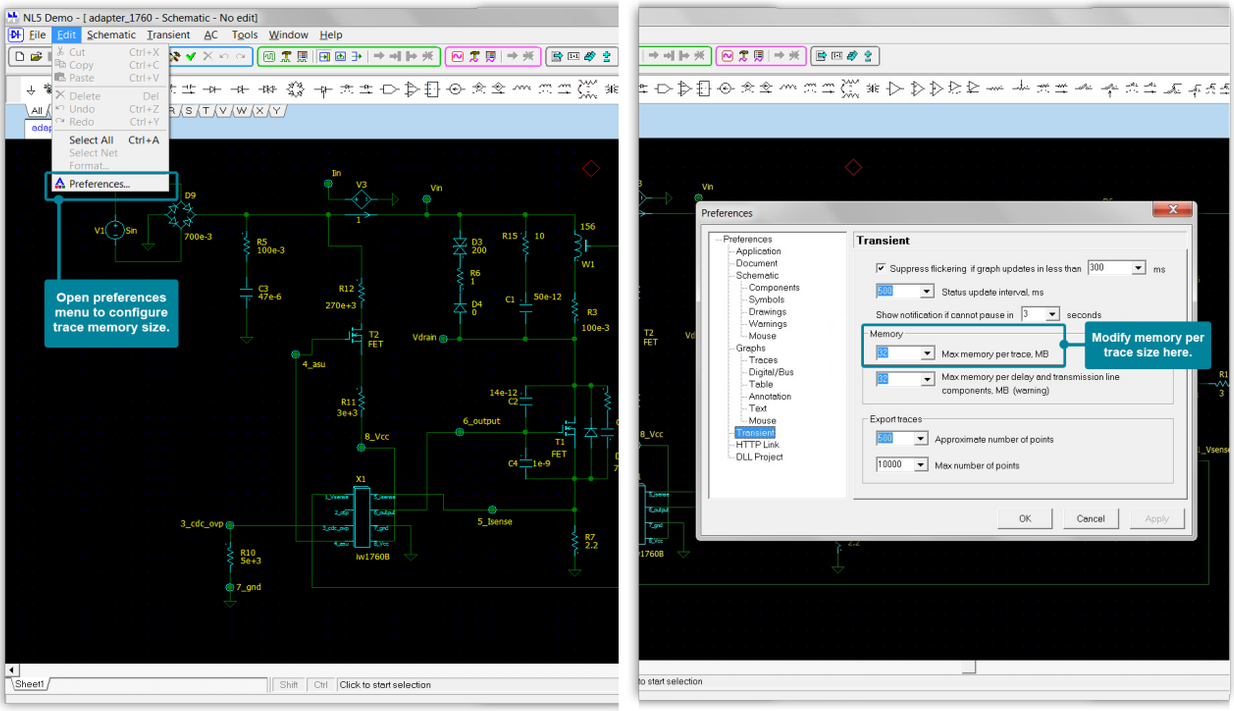
The simulation tool uses finite time steps to calculate the instantaneous value of the circuit. When doing a full circuit simulation, the smaller the calculation step, the better the results (although smaller calculation steps result in longer simulation time and larger data files). For longer transients when no switching is expected, the calculation step time can be increased to expedite the simulation time. Then, with the transient paused, you can adjust the calculation step to a much lower level to continue the transient for the detailed analysis.



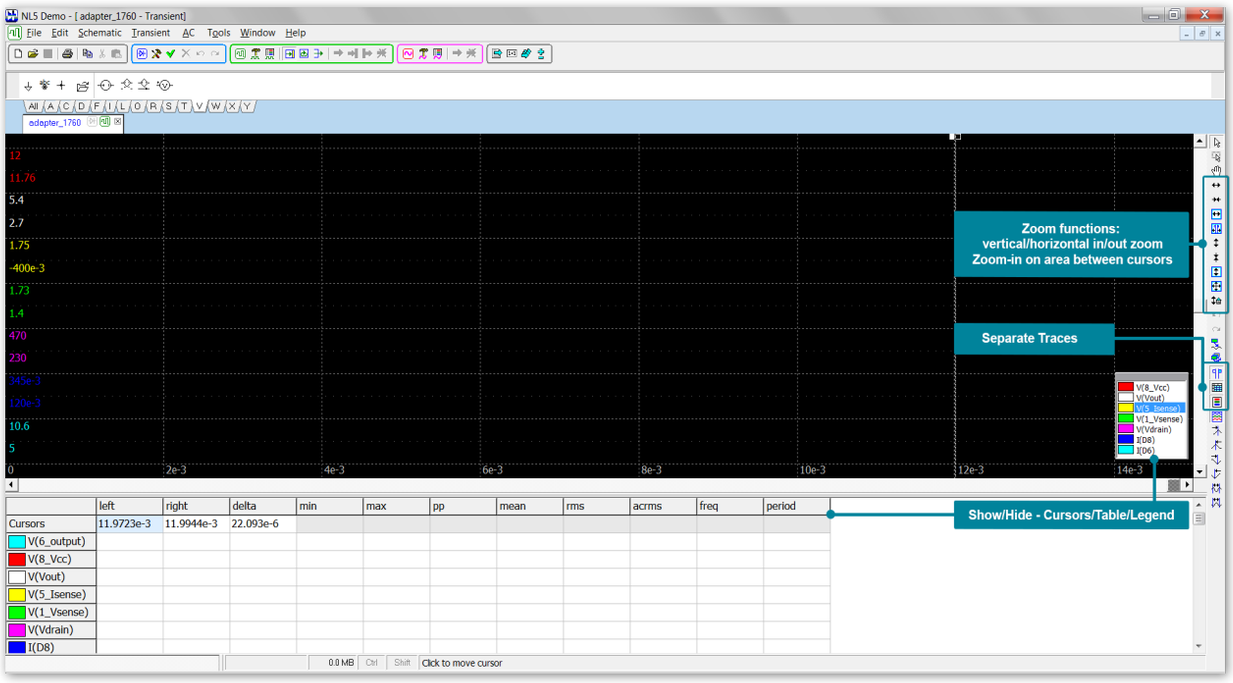
EXAMPLE: When simulating the turn-on time of an AC/DC converter (that uses a passive or active start-up circuit), nothing will occur inside of the converter until the voltage on the V_{CC} pin reaches a minimum threshold, after which the converter begins switching and the output voltage ramps to its nominal value. The time needed to charge up the supply voltage from the high voltage rail can take hundreds of milliseconds to seconds depending on the size of the start-up resistors. For normal active simulations, the calculation step should be 15ns or smaller. For this start-up time period, where the simulation is essentially waiting for a resistor to charge up a capacitor, you can increase the simulation step to a much larger value, for example 1ms, allowing the simulation to advance much faster. But, to get accurate results, the simulation must be paused and the calculation step modified back to the 15ns or better point prior to the rest of the circuit activating. The **PAUSE/ CONTINUE** buttons are key to this feature and it is important to avoid using the **STOP** button until you have achieved the desired simulation results.

3.3. Trace Memory Settings

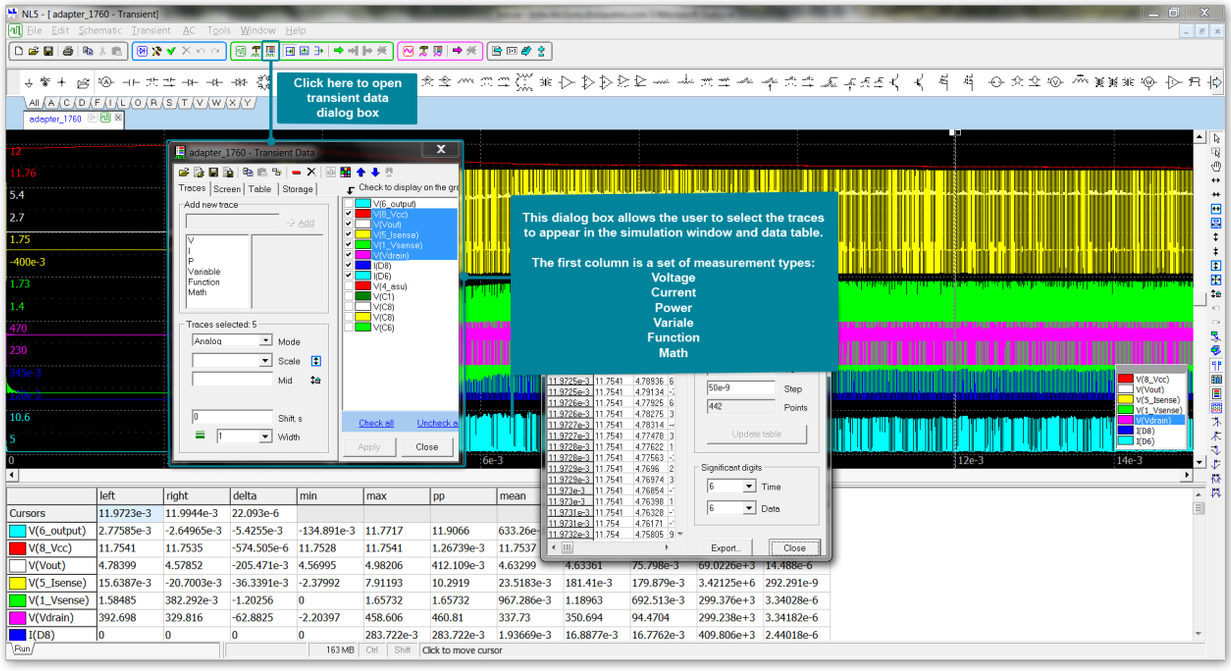
The software stores the data for each trace displayed in the simulation window until the memory allotted for the trace has filled, at which point the data set will be truncated by deleting data at the beginning of the trace and the user will be notified. To avoid this when running long simulations with multiple traces, configure the maximum trace memory to be a relatively high value.



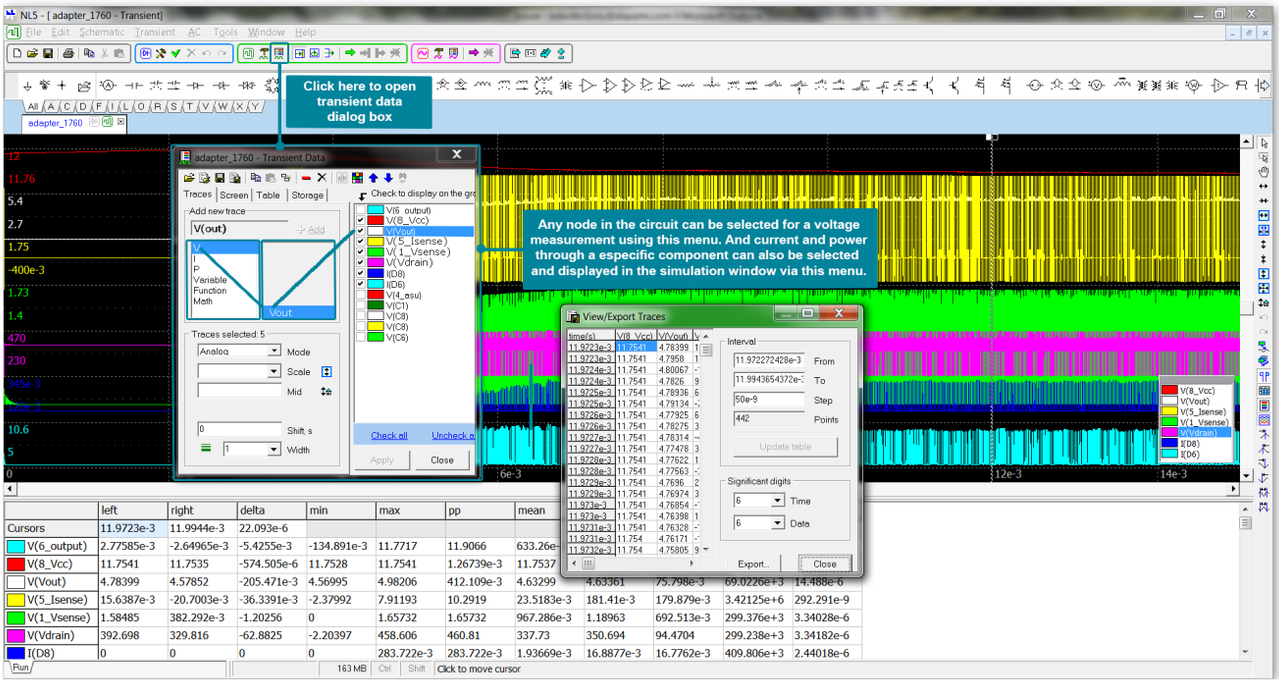
3.4. Simulation Window. Viewing Simulations



The traces displayed in the simulation window can be selected via the Transient Data quick-access button.



Voltages, currents, power and other advanced functions can be displayed.



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I(D8)	0	0	0	0	283.722e-3	283.722e-3	1.93669e-3	16.8877e-3	16.7762e-3	409.806e+3	2.44018e-6

The table shows the data from the simulation traces included in the window above.

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