Introduction to Simulation Environment

Targeted simulator: OrCAD

About this document

Scope and purpose:

The current document provides guidance on how to get started with the attached behavioral model using the OrCAD Simulator either by creating a new project from scratch or based on an existing testbench like the one attached to the current archive.

Important note:

This document has been created for general purposes and has NOT been tailored to any specific product. Therefore, the naming of symbols, testbenches and other files will differ from the ones included in the delivery package.

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1. Resources

The minimum files required to follow the steps from this document can be found in the current archive with the following extensions:

- **.lib :** the model code – to be found either as encrypted (to protect Infineon's IP) or unencrypted format
- **.olb :** schematic symbol view for graphical user interface
- **.opj** : project file which contains one/several application setup(s)

2. Starting a new project

The instructions presented below assume basic knowledge like opening a schematic and running a simulation. If necessary, please get familiar with simulation environment before proceeding.

2.1. Create a new project

Begin by opening the OrCAD Capture CIS application. From **File** menu→**New**→**Project**, select the project type as **PSpice Analog Mixed A/D** to enable simulation and then specify the name of the project and a directory as storage placeholder. For example:

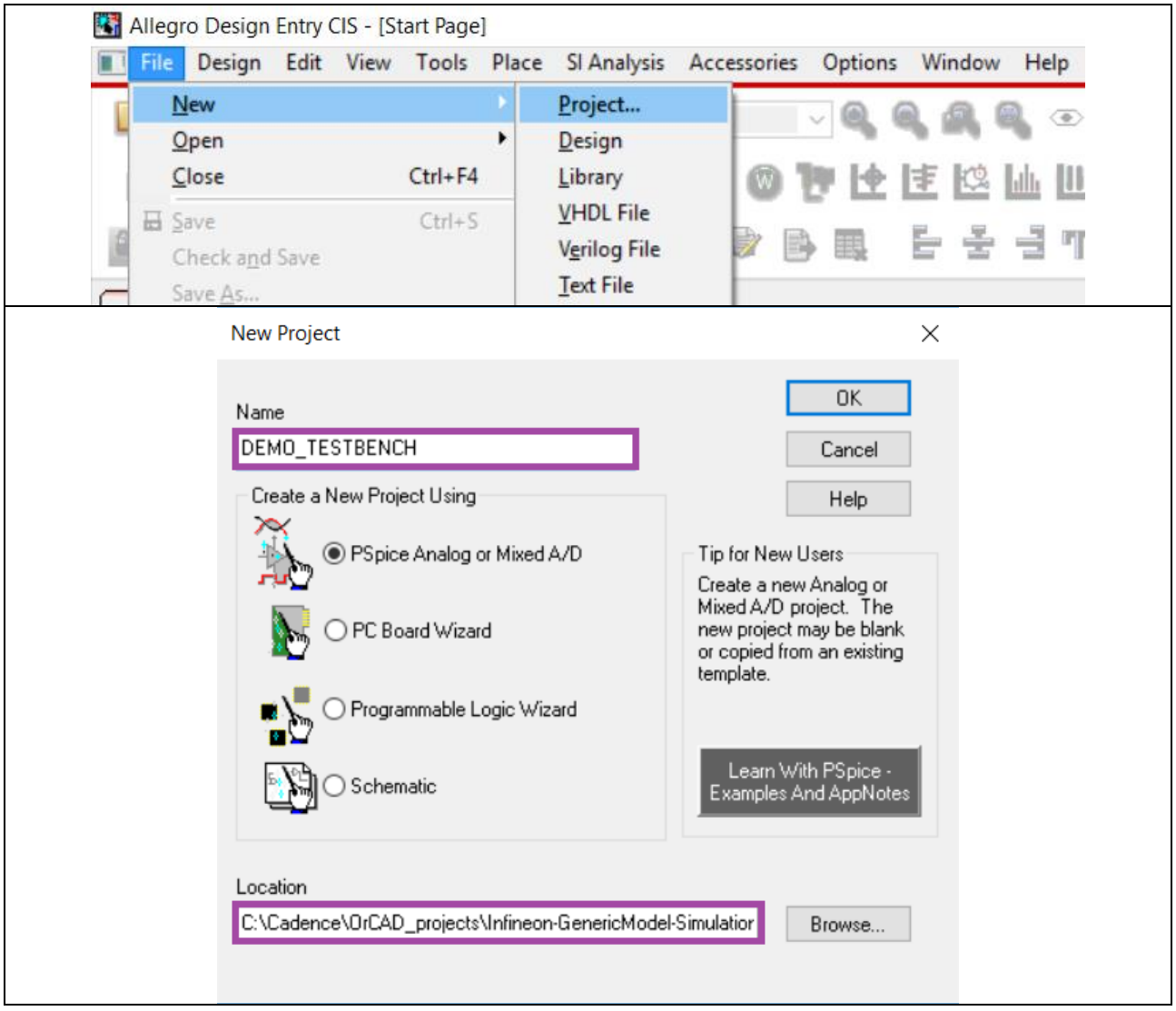


Figure 1 Create new project

- After pressing OK, select the **Create a blank project** option in the **Create PSpice Project** pop-up and confirm with OK (Figure 2)

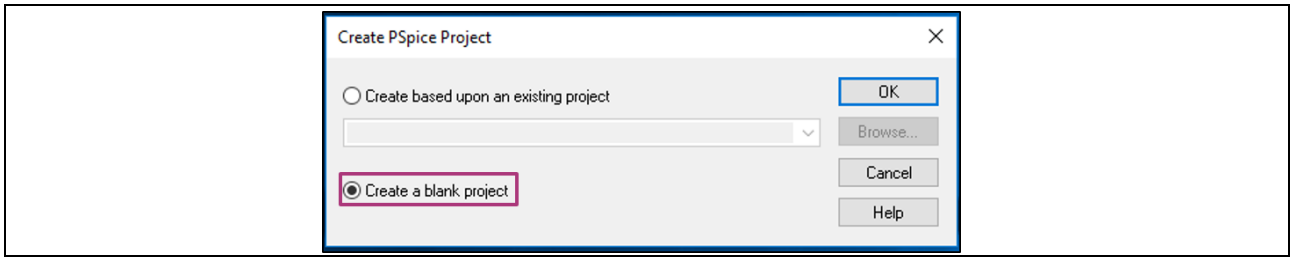


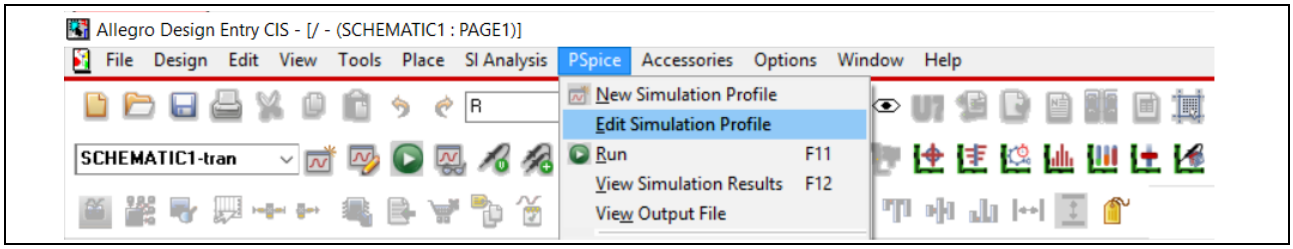
Figure 2 Blank project

2.2. Import of an existing model

To simulate a model in schematic mode, **Cadence OrCAD** requires two types of input files: **"GENERIC_MODEL.LIB"** (device behavior source code) and **"GENERIC_MODEL.OLB"** (schematic symbol view with device pinout). These two types of files are generally referred to as a library.

2.2.1. Importing a .lib file

- From **PSpice** menu choose **Edit Simulation Profile**.
- Once the **Simulation Settings** window pops up navigate to the **Configuration Files (1)** tab and under **Category** select **Library (2)** (Figure 3)
- Click **Browse (3)** next to the **Filename** location bar and select the model ***.lib** file
- After validating the selection, choose one of the three modes of library assignment:
  - **Add as Global (4)** - to all designs
  - **Add to Design (4)** - for current design only (recommended)
  - **Add to Profile (4)** - local to the current test-bench inside the current design
- If the "**nom**" library is not automatically listed in the **Simulation Profile,** it must be added from**: C:\Cadence\SPB_17.2\tools\Pspice\Library\nom.lib (5)**



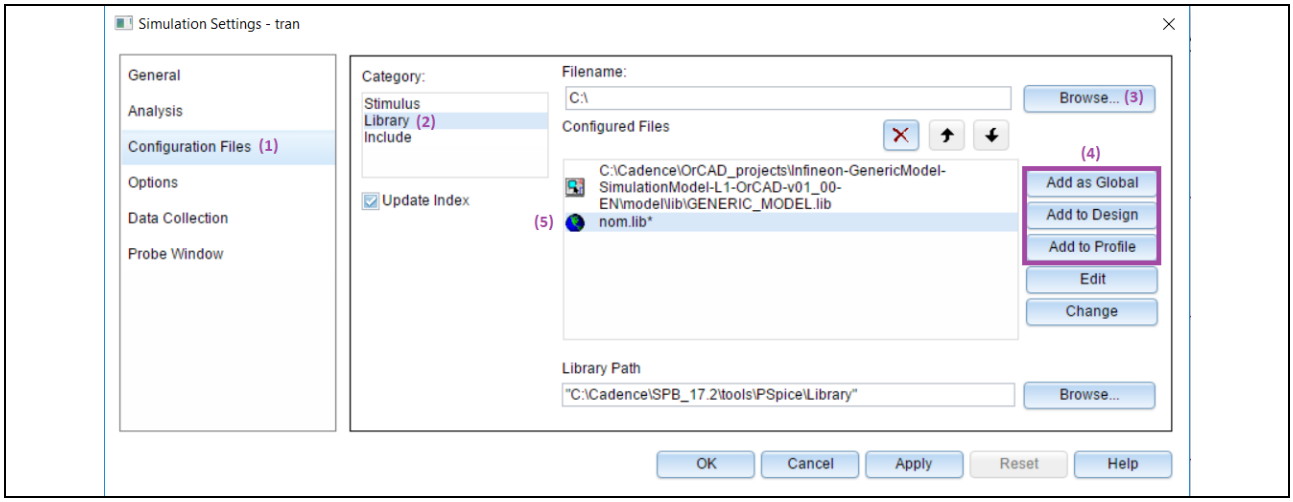


Figure 3 Import .lib file

2.2.2. Importing an .olb file

- From the Project tab, under **Design Resources**, right-click on **Library (1)** and choose **Add File (2)**
- In the pop-up window, browse for the **.olb** file **(3)**

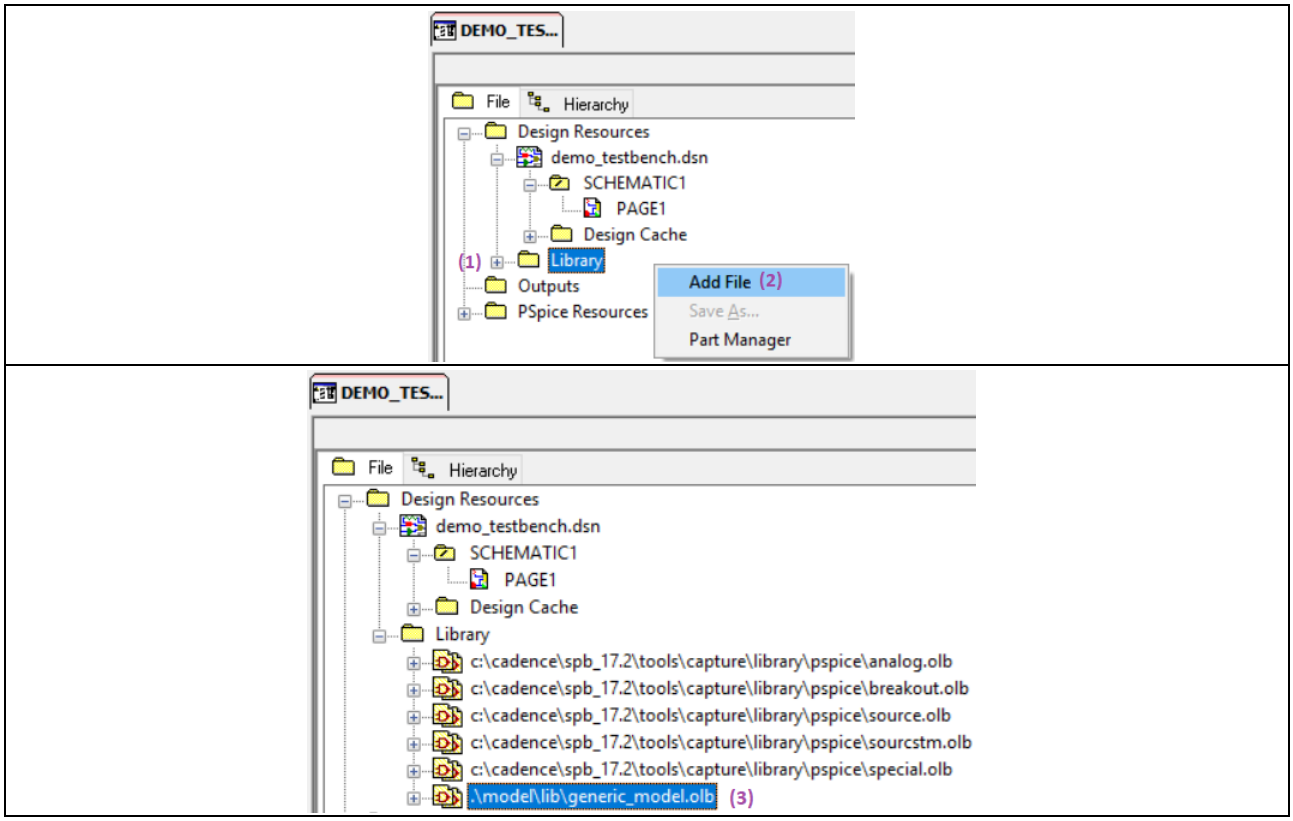


Figure 4 Import .olb file

- Search in the Place Part sidebar or press “P” on the keyboard and place the symbol in the desired schematic **(4)**

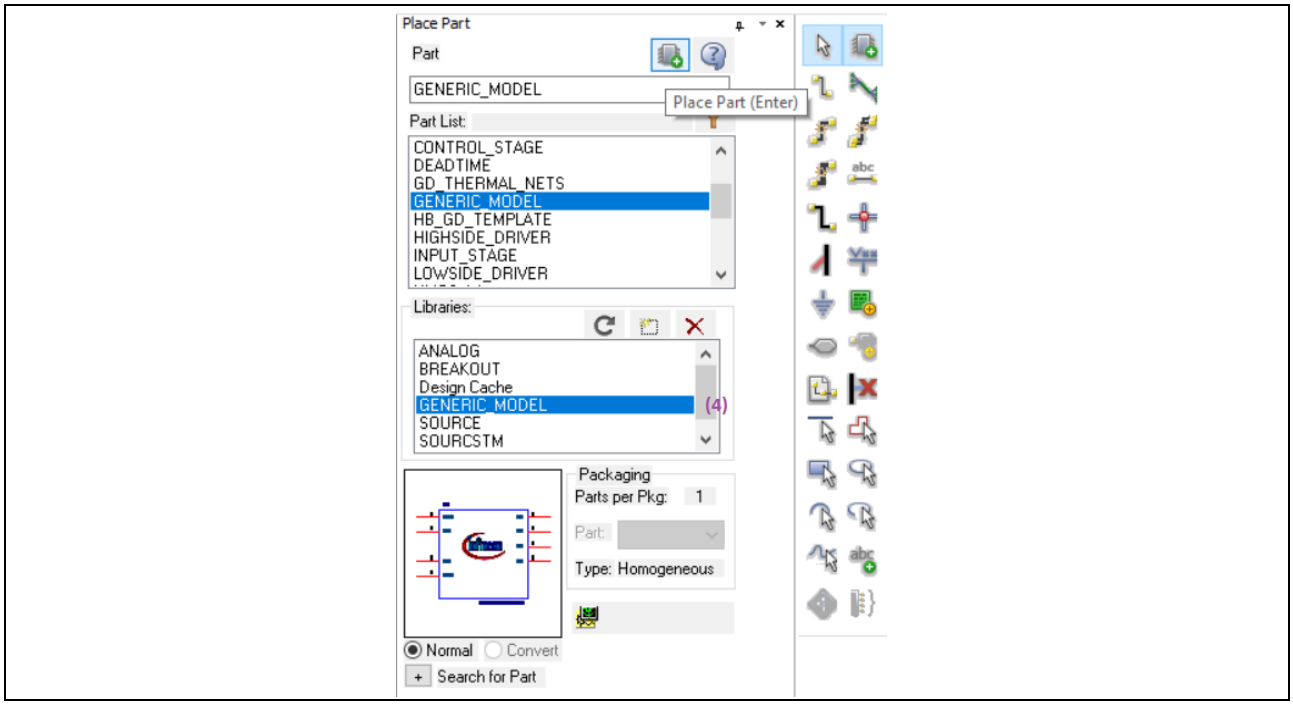


Figure 5 Place part

2.2.3. Generating an .olb file

- Open the AMS Model Editor tool from the Cadence suite.

NOTE: Please note that the provided symbol files are compatible with all major releases of OrCAD starting with version 16.2 onward.

- From **File** menu→**Open**, **(1)** navigate to the "lib" directory in the package and select the "GENERIC_MODEL.lib" file. **(2)** (Figure 6)

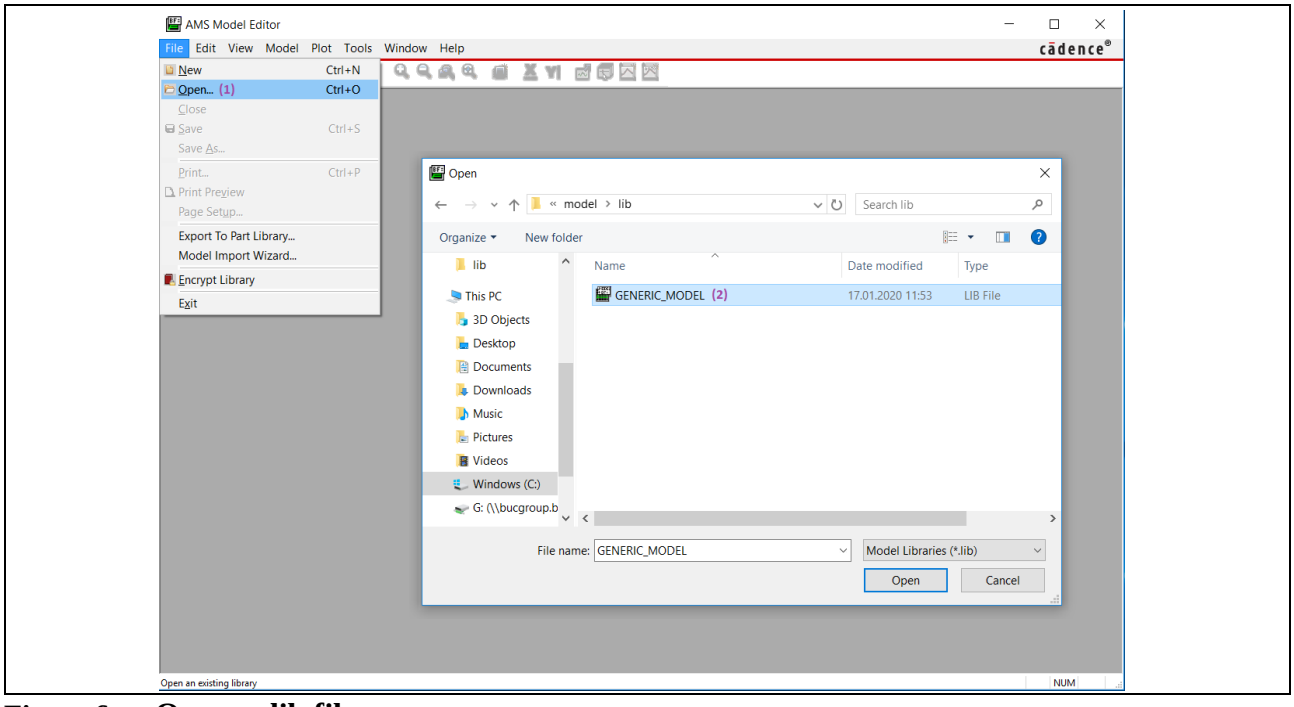


Figure 6 Open a .lib file

- From **File** menu→**Export to Capture Part Library…** **(3)** press the lower **Browse** button next to the "Enter Output Part Library:" location bar **(4),** if you want another location for the symbol and select the new desired save location for the symbol file; otherwise, after **(3)** just click OK (Figure 7)

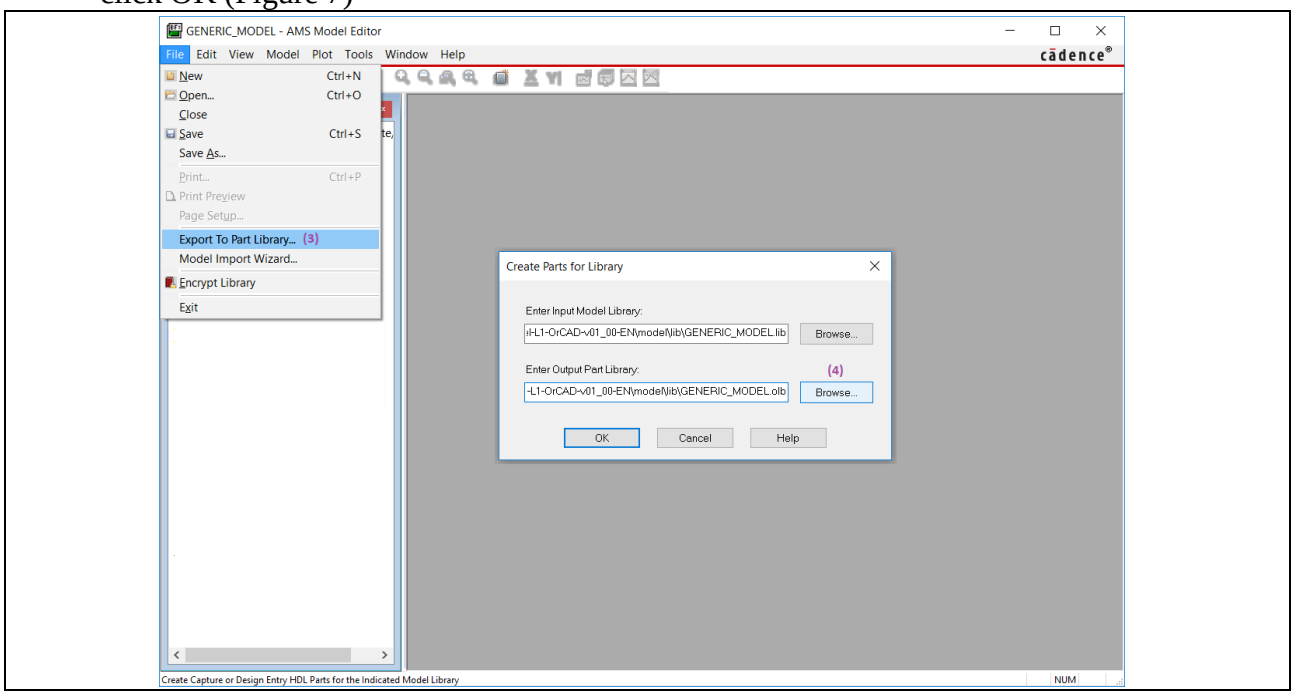


Figure 7 Generate a new symbol

- The report will confirm the creation of the symbol with 0 error and 0 warning messages

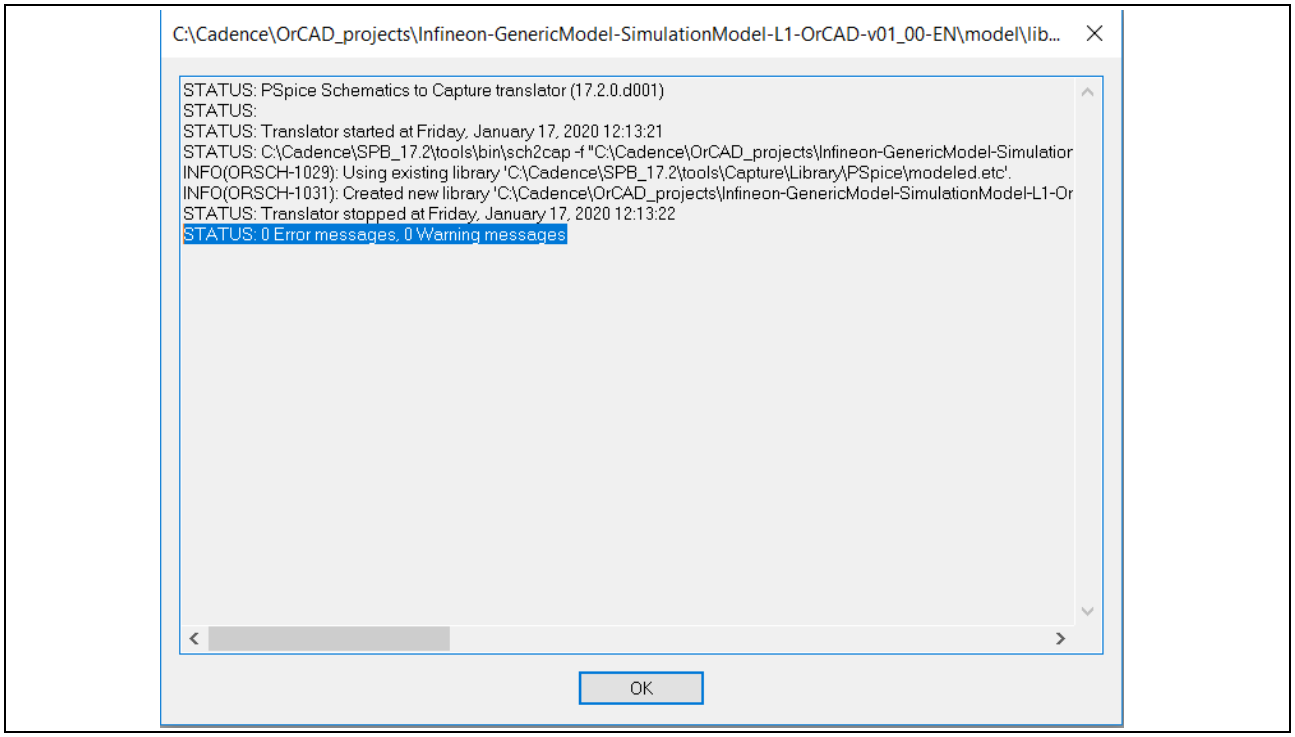


Figure 8 Successful message

2.3. Set up and run a transient analysis

A Transient Analysis will evaluate the behavior of the circuit in the time domain, similar to what an oscilloscope displays in the lab. To perform this analysis follow the next steps:

- From the main menu select **PSpice** and choose **New Simulation Profile**
- Set the name of the simulation profile and click on **Create** (1)

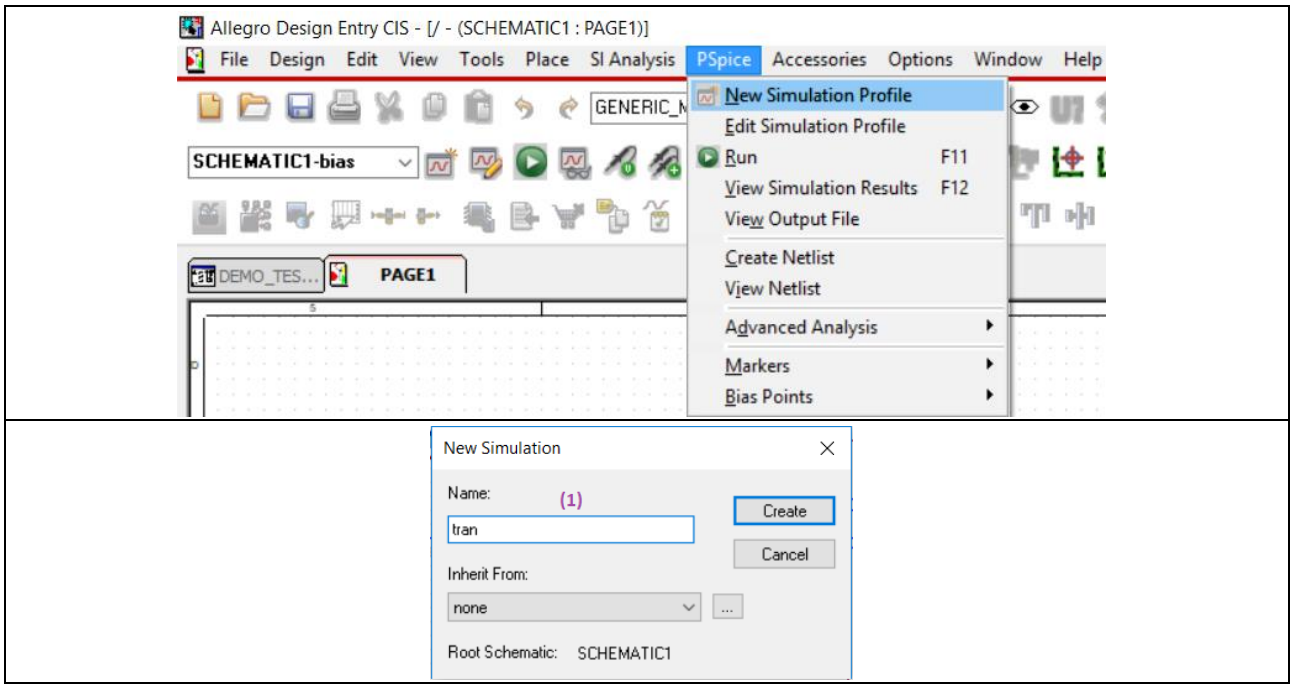


Figure 9 New simulation profile

- **Simulation Setting** dialog box appears

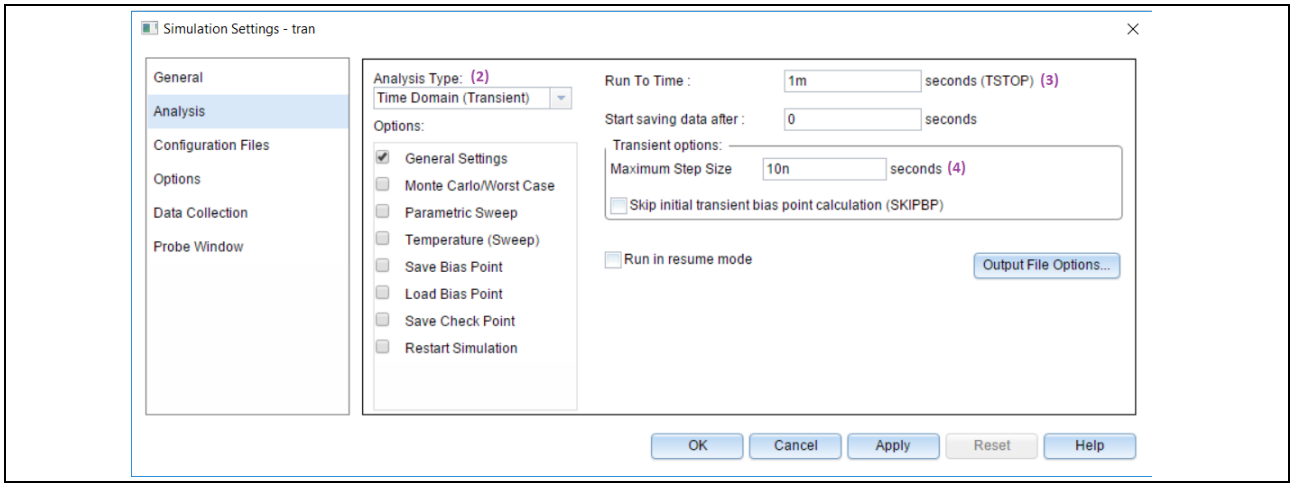


Figure 10 Simulation settings

- From the **Analysis Type** list, select **Time Domain (Transient)** (2) and specify the required parameters:
  - **TSTOP** (3) = total simulation time

- **Maximum step size (4)** = defines the maximum internal step size, which is dependent on the specified **TSTOP** parameter

- Under **Simulation Settings** go to **Options (5)** tab, select the Category **Gate Level Simulation (6)** and then make sure that **"0"** is selected from the dropdown list of the **DIGINITSTATE (7)**:

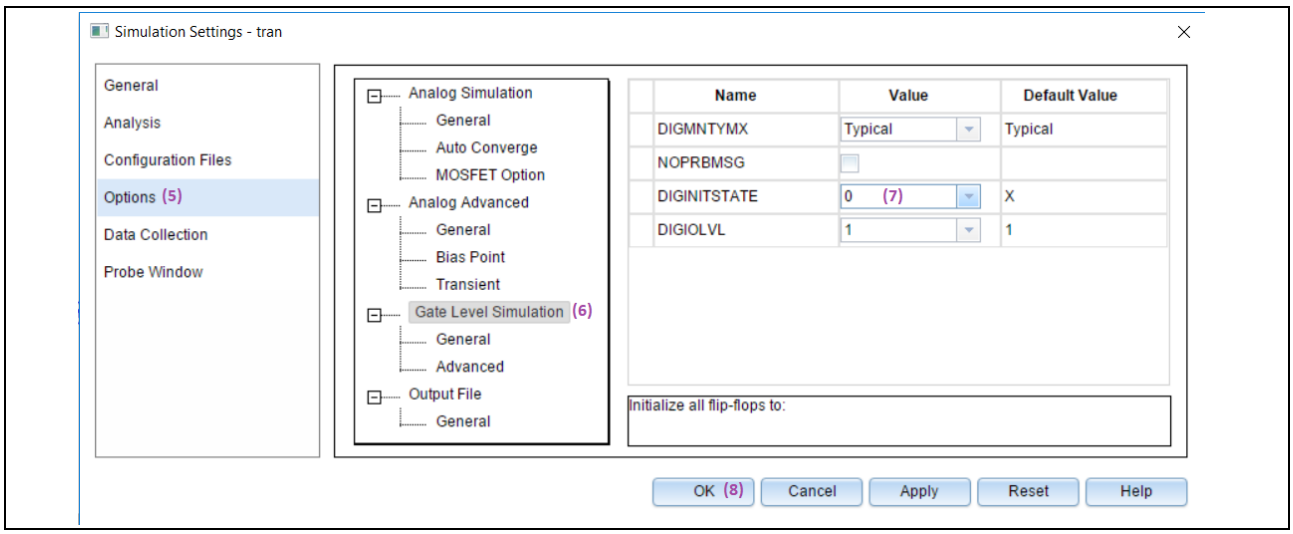


Figure 11 Simulation settings

- Click **OK** to close **Simulation Setting** dialog box **(8)**
- From **Pspice** menu, press **Run** to perform the analysis

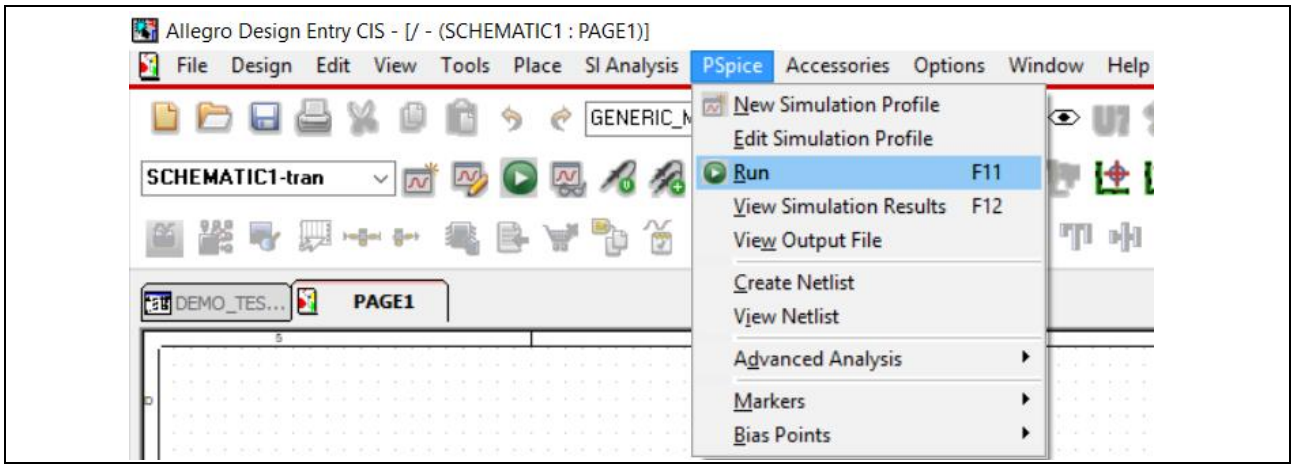


Figure 12 Run the simulation

2.4. Set up global parameters

A model parameter allows the user to have a direct control over specific components inside the circuit at any hierarchical level with the following purposes:

- Apply the same value to multiple part instances.
- Set up an analysis that sweeps a variable through a range of values (for example, DC sweep or parametric analysis).

To declare a global parameter in Cadence OrCAD:

- Search in **Place Part** sidebar the instance **PARAM (1)**
- Select **PARAM** (from the library named **"SPECIAL"**), double click on it and place it on your schematic page **(2)**
- If the **"SPECIAL"** library is missing, load it from: **C:\Cadence\SPB_17.2\tools\capture\library\pspice\special.olb** as show in the section above – **2.2.2. Importing an .olb file**

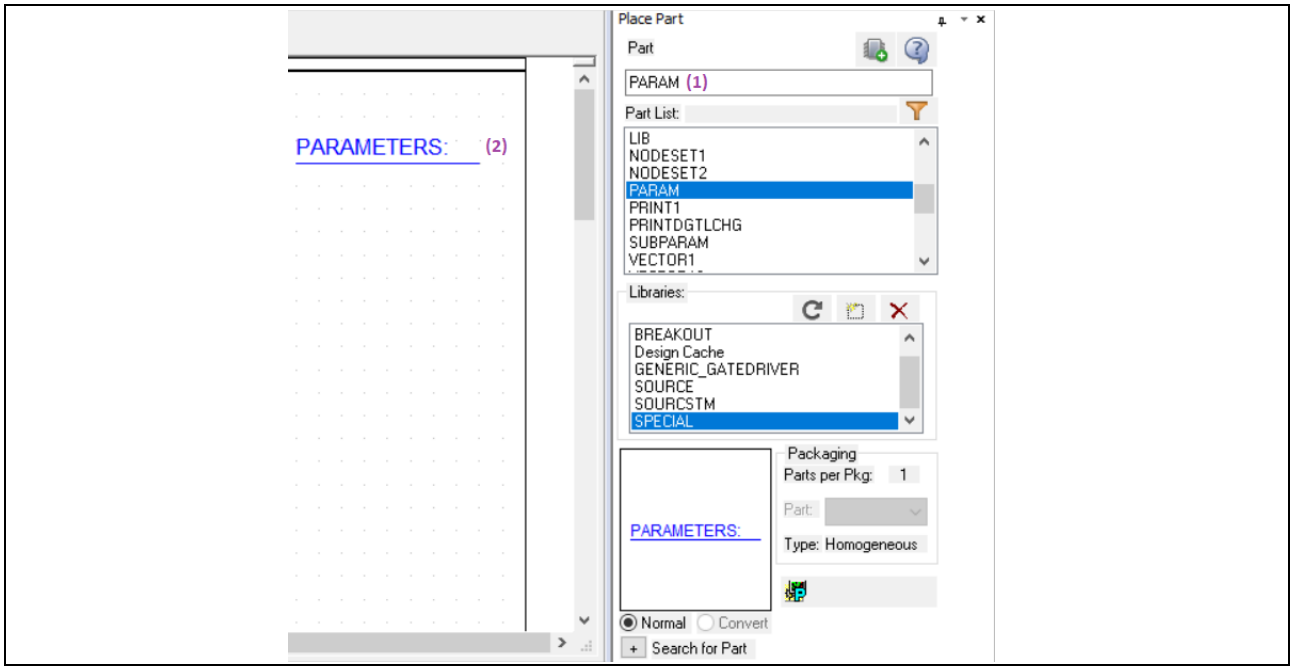


Figure 13 Global parameter

- Double click it to start the spreadsheet editor
- Click New Property **(3)**
- Type the Name and Value and press OK **(4)**

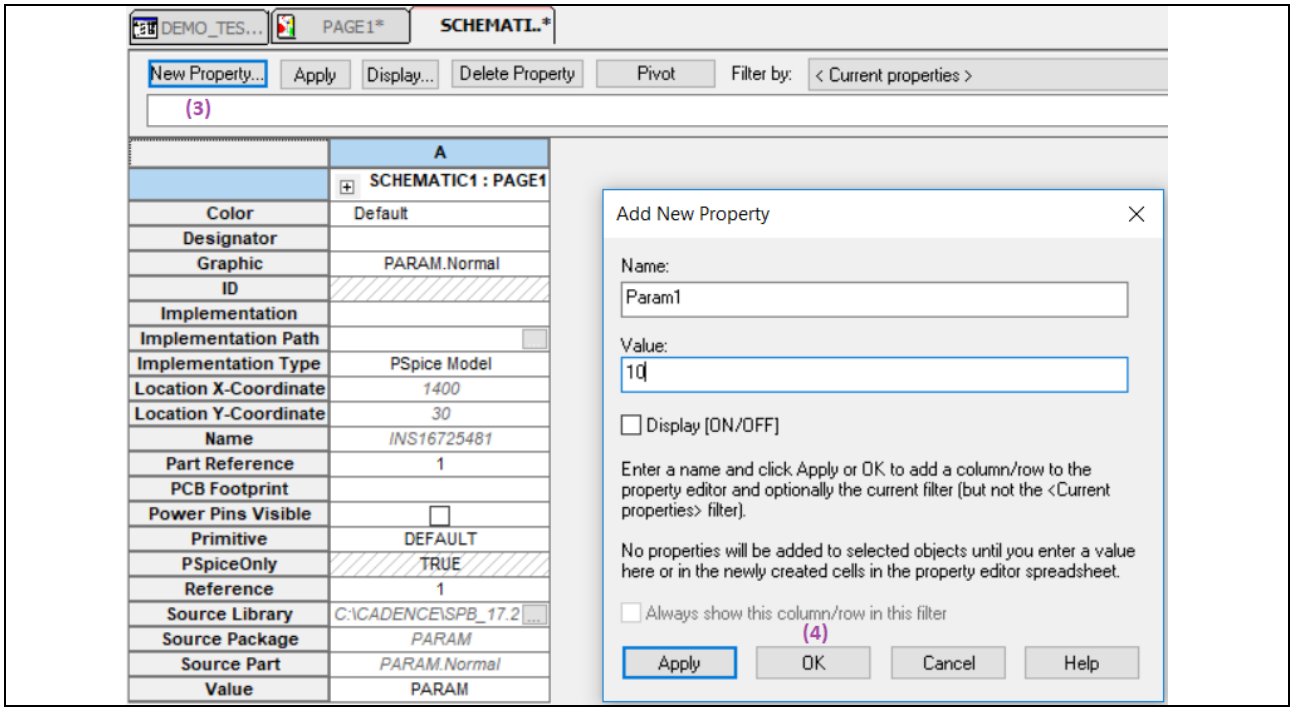


Figure 14 Add new parameter

- Right-click on Param1 on the **Display option (5)**, select **Name and Value (6)**, then click **OK (7)** (it will show up on the testbench)

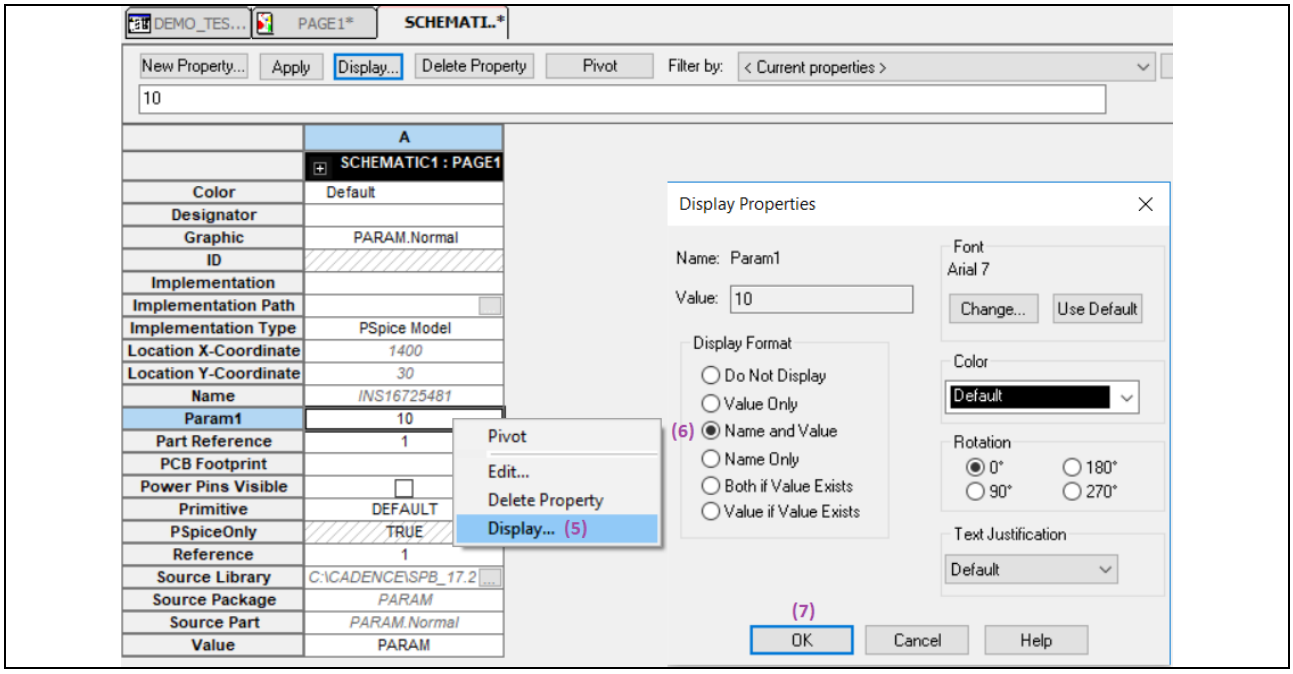


Figure 15 Display a global parameter

Two practical examples are shown below:

- Apply the same value to multiple instances: in the value field of any component use the parameter name between curly brackets

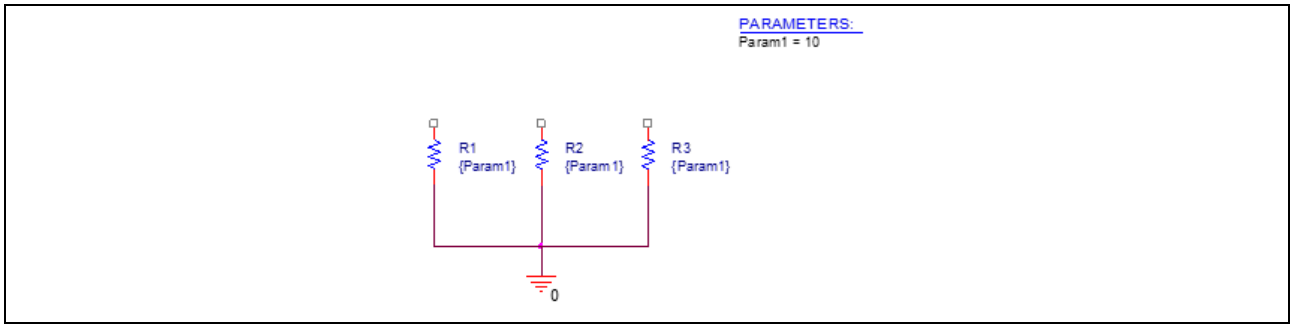


Figure 16 Global parameter for multiple instances

- Set up an analysis to sweep a variable through a range of values. The effect is the same as running the circuit several times, once for each value of the swept variable. To perform this analysis follow the steps from **Figure 17**.

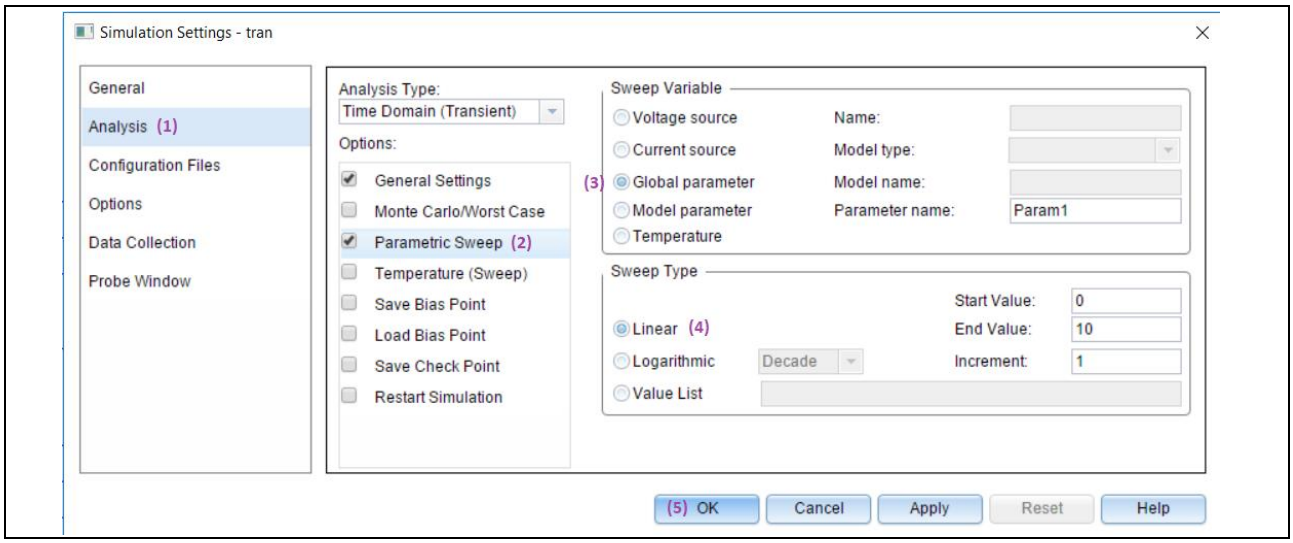


Figure 17 Set up a parametric simulation

2.5. Recommended simulation settings

As **PSpice** was not originally designed for power electronics and highly non-linear components, the simulation parameters (**PSpice → Edit Simulation Profile → Options**) may be optimized for a specific design.

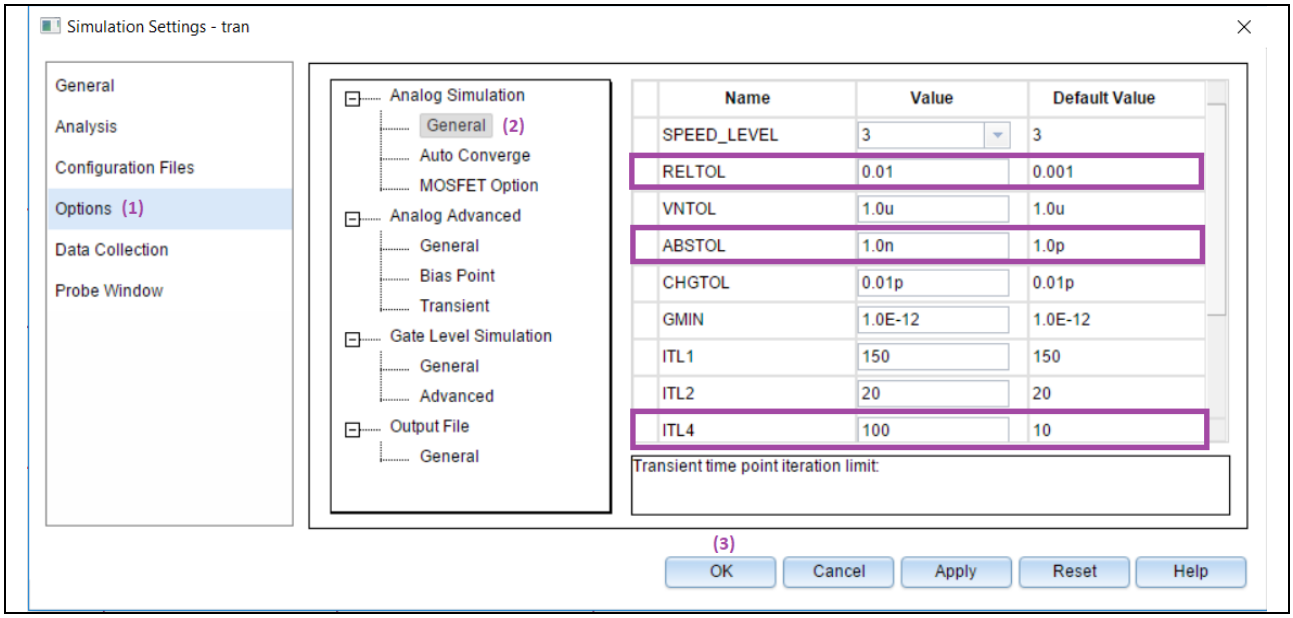


Figure 18 Simulation parameters

The following recommended values facilitate convergence:

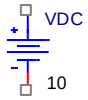
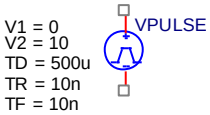
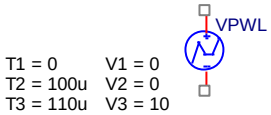
Table 1 Recommended values for simulation parameters

RELTOL=0.01	relative accuracy of voltage and currents
ABSTOL=1nA	maximum current accuracy
ITL4=100	maximum number of iterations for transient analysis

In general, the delivered models need to detect a rising edge starting from 0V on Inputs and Supply voltages to properly for a proper start-up sequence. It is recommended to use **VPWL** or **VPULSE** instead of **VDC** component.

TIP: In order to avoid the simulator's potential convergence issues please avoid using voltage sources such as VDC components as most of the models require a power-up pattern starting for at least a couple of micro-seconds from a zero volts supply. Therefore, it is best-practice to use sources like VPULSE or VPWL as shown below:

Table 2 Table A

VDC	VPULSE	VPWL
		
		

3. Opening an existing project

Typically, the model is delivered with an attached demo_testbench which is already configured and is ready for use.

3.1. Transient simulation considerations

Open the OrCAD Capture CIS application and from the **File** menu select **Open→Project.** In the browse window locate and open the "DEMO_TESTBENCH.opj" file from the Infineon-GenericModel-SimulationModel-L1-OrCAD-v01_00-EN package directory. For example:

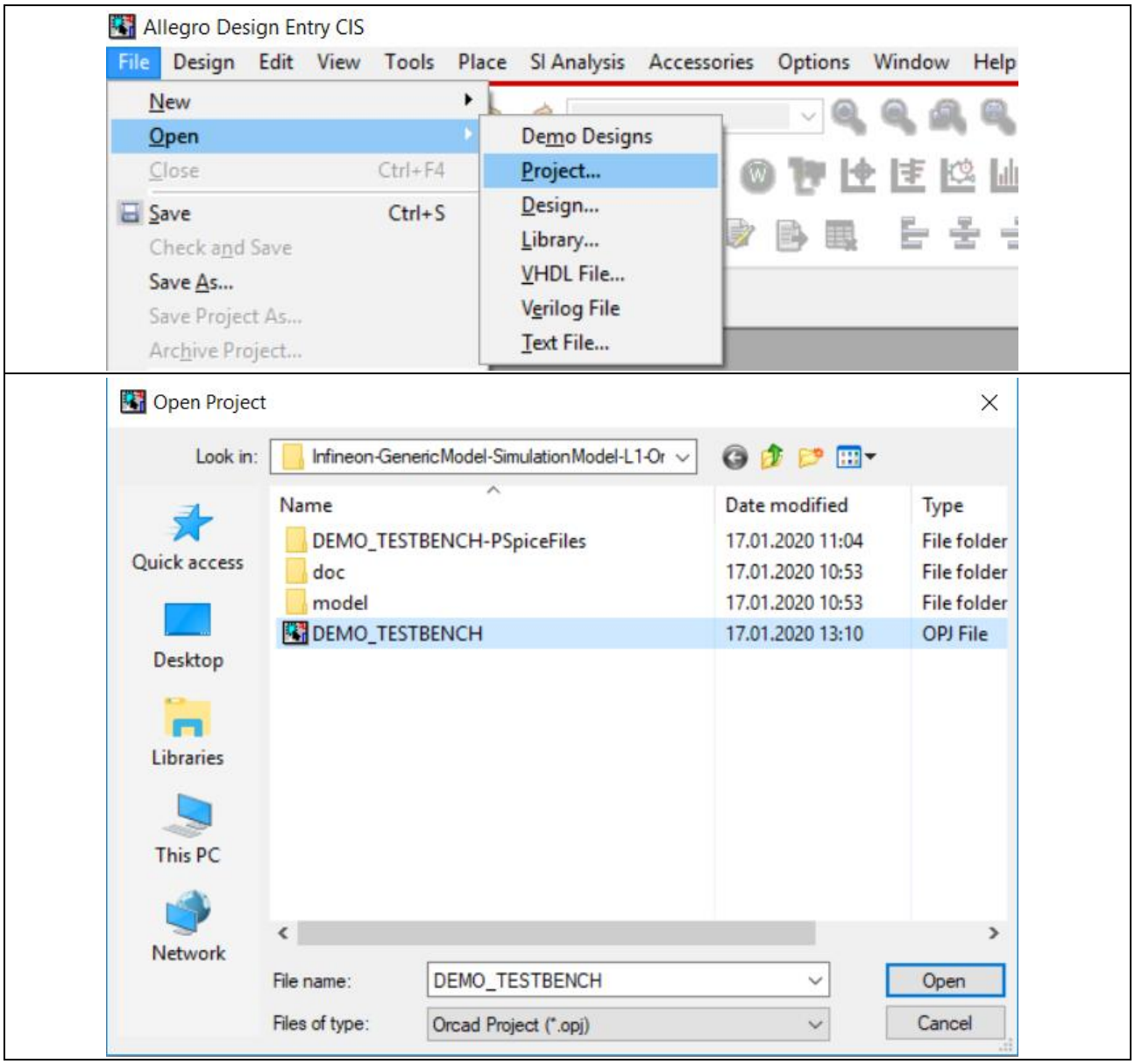


Figure 19 Open an existing project

- Navigate to **PAGE1** of **SCHEMATIC1** in the project tree **(1)** and right click on it→**Edit Page** to open the schematic. **(2)** In this section, one or more demo testbenches can be found with all the components and their values.

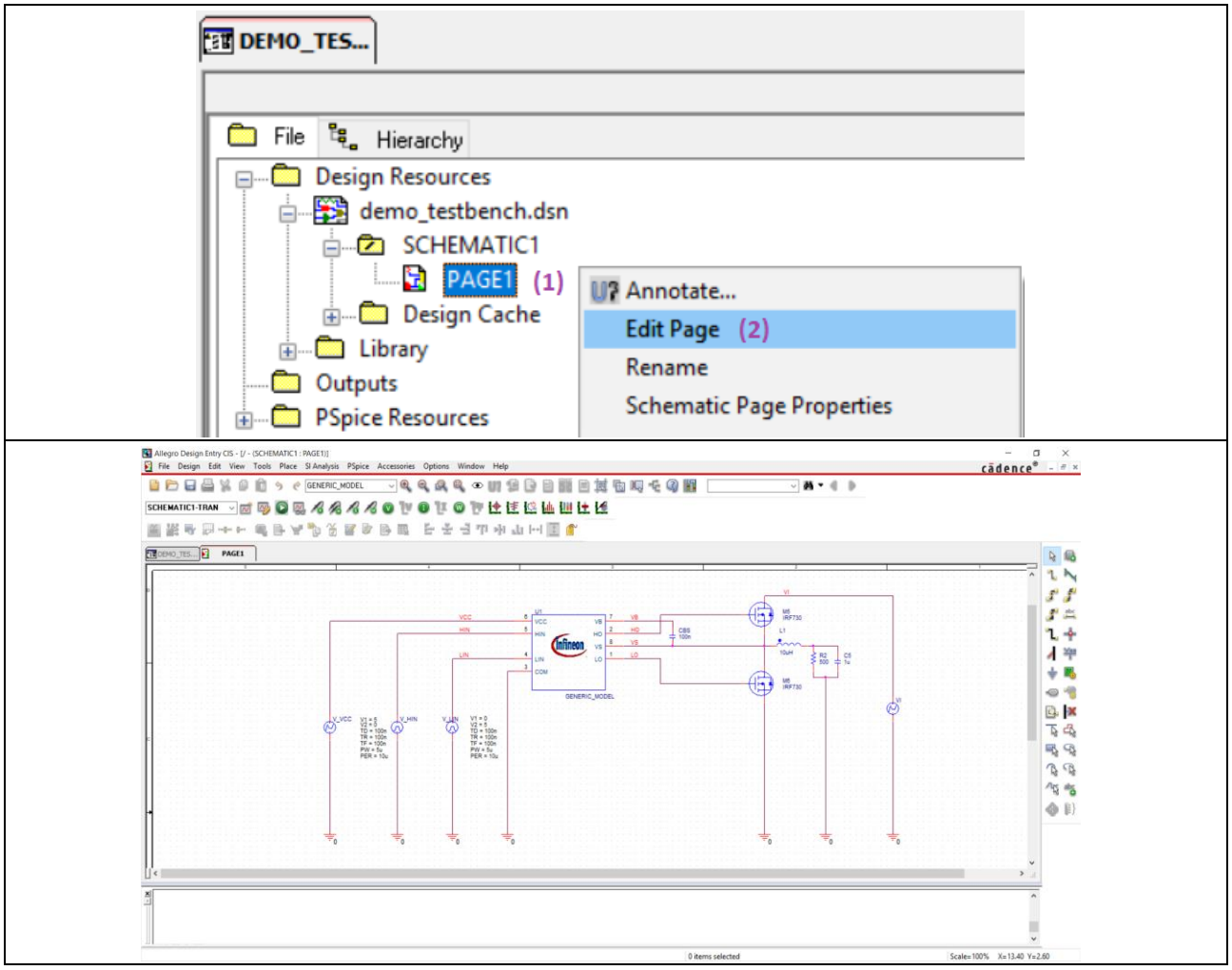


Figure 20 Open the demo_testbench

- To start the simulation, press “F11” on the keyboard or open the **PSpice** menu and click **Run**. Alternatively, the play button on the PSpice toolbar can be used
- Once the netlist has been generated the “Allegro AMS Simulator” (PSpice) will open; and the simulation will automatically start. A progress bar will be shown in the bottom right corner **(3)**
- After the simulation reaches 100% the signals can be plotted. To do this, click on the **Trace** menu→**Add trace** or press **Insert** button on the keyboard or press the **Add trace** pictogram from the toolbox **(4)**
- To plot the signals please select them from the list then press “OK” button **(5)**

Note: Filtering of the desired signals can be done using the check boxes in the middle of the window by their type (e.g. voltages, currents, power, etc. **(6)**)
Signals can also be composed with the functions available in the right side list “Functions or macros” **(7)**.

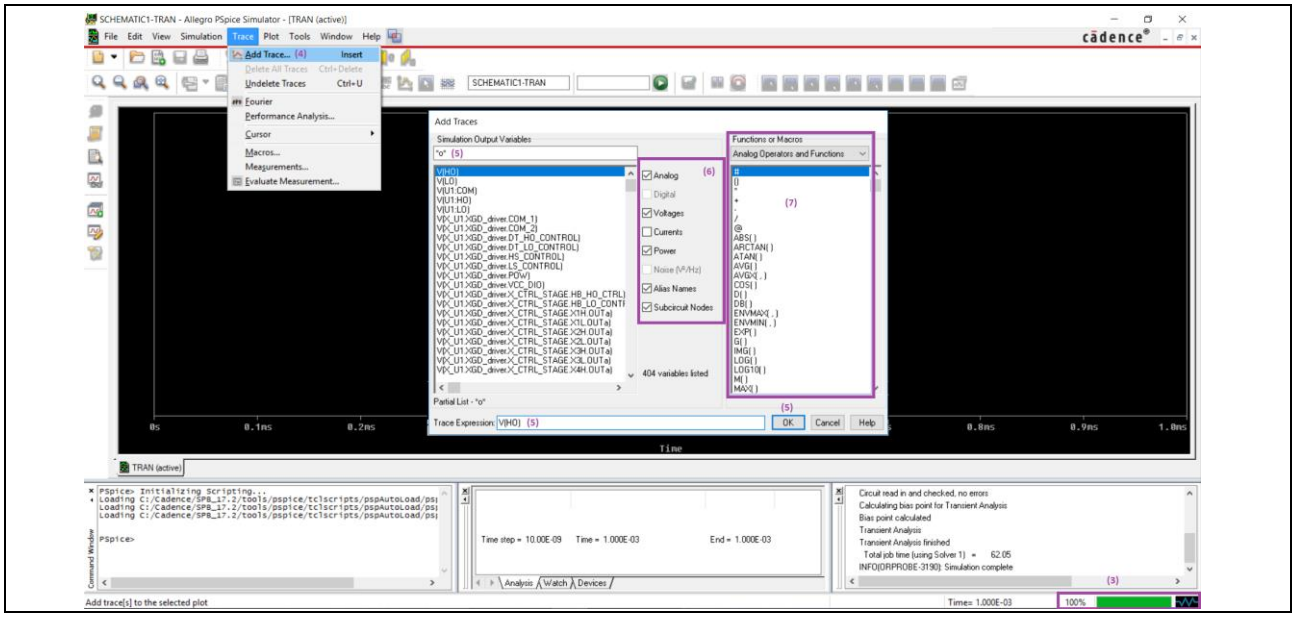


Figure 21 Plot signals

- To add other windows, click on **Plot** menu→**Add Plot to Window**

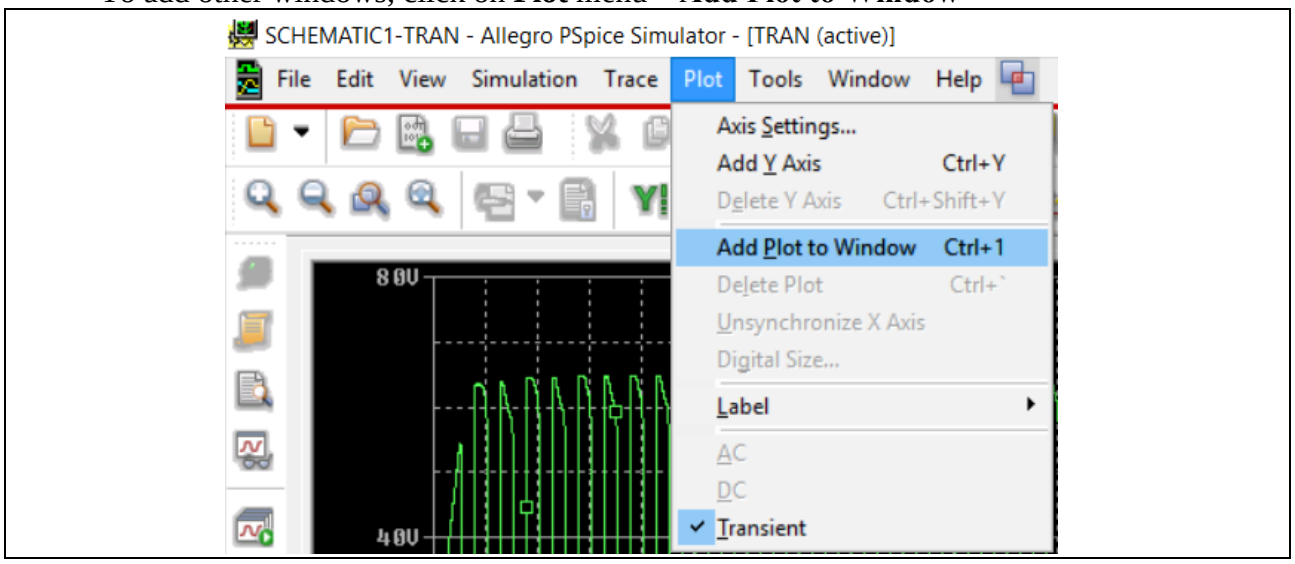


Figure 22 Plot a new window

- Cursors for signal value measurement can be added from the **Trace** menu→**Cursor→Display** or by left clicking the "Display Cursors" pictogram on the toolbox (Figure 23)

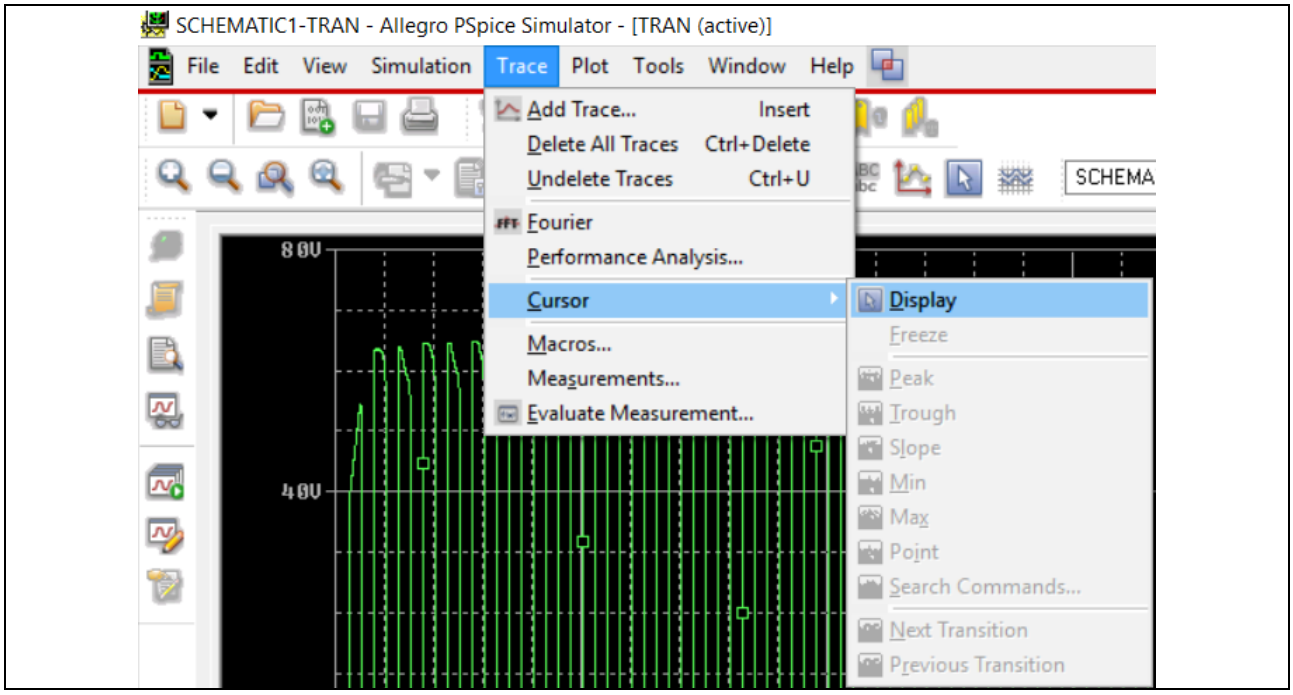


Figure 23 Add a cursor

- On the bottom right corner a table measurement menu can be observed

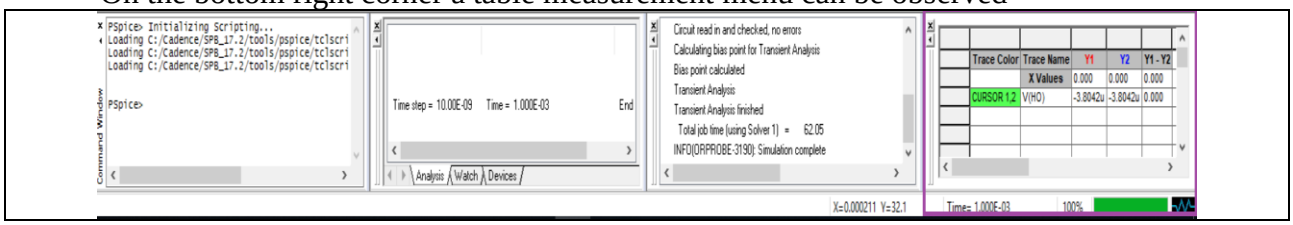


Figure 24 Measurement values

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8.2 Should any provision in these Terms of Use be or become invalid, the validity of all other provisions or agreements shall remain unaffected thereby.

Revision history

Document version	Date of release	Description of changes
Rev 1.0	2020-01-20	GettingStarted released