Getting started

Targeted simulator: OrCAD PSpice

About this document

Scope and purpose

The current document provides guidance on how to get started with the attached simulation model using the **OrCAD PSpice** simulator either by creating a new project from scratch or based on an existing test bench like the one attached to the zipped archive.

Intended audience

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

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1 Resources

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

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

2 Starting a new project

Instructions presented below assume basic knowledge of the simulation environment such as opening a schematic and running a simulation since this document is not a comprehensive instruction manual for PSpice.

2.1 Create a new project

Begin by opening the **OrCAD Capture CIS** application. From **File** → **New** → **Project**, select the project type as **PSpice Analog Mixed A/D** to enable the simulation. Then specify the name of the project and a directory as storage placeholder. **Figure 1** below shows an example.

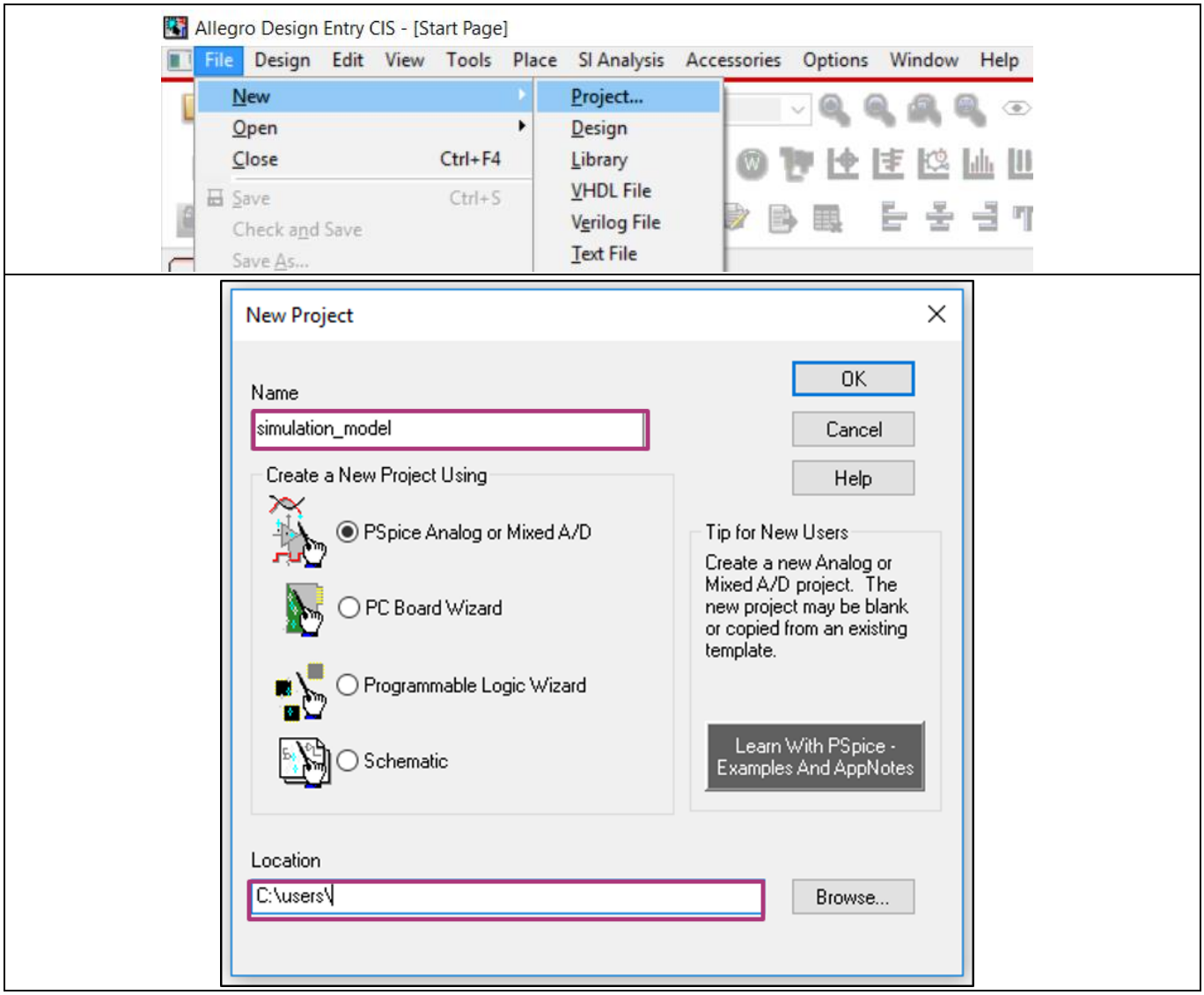


Figure 1 Create new project

After pressing **OK**, select the **Create a blank project** option in the **Create PSpice Project** pop-up and confirm by clicking **OK**, as shown in **Figure 2**.

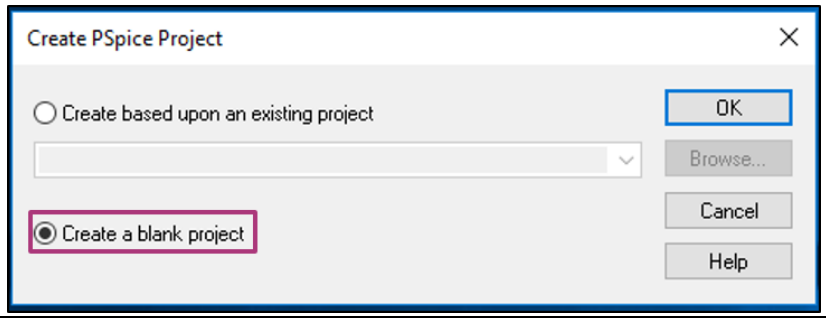


Figure 2 Blank project

A schematic page will be created in the project automatically. In order to create a new schematic page, right click on the design file (**.dsn**), select **New Schematic**, choose a name and press **OK**. To continue, right-click on the newly created schematic folder and choose **New page**. A schematic page will appear.

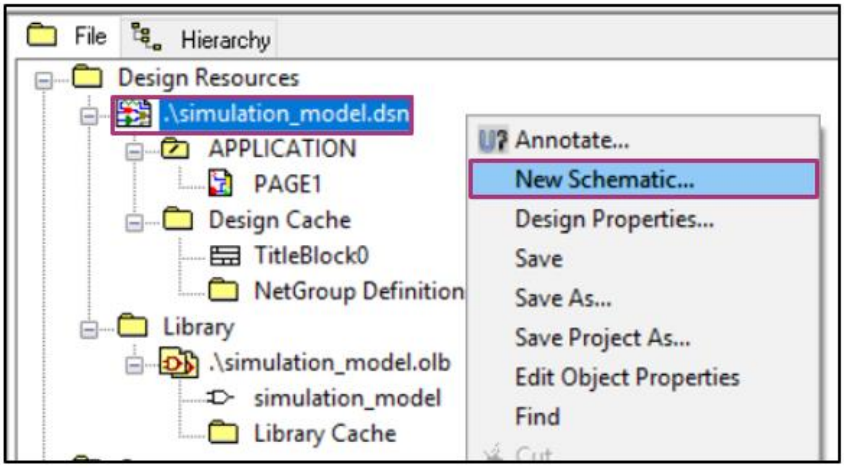


Figure 3 New Schematic

2.2 Import of an existing model

*Note: To simulate a model in schematic mode, **Cadence OrCAD** requires two types of input files: **"simulation_model.lib"** (device behavior source code) and **"simulation_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

Figure 4 describes the following steps. From **PSpice** menu choose **Edit Simulation Profile**. Once the **Simulation Settings** window pops up navigate to the **Configuration Files** (1) tab. Under **Category** select **Library** (2). 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 (4):

- **Add as Global**: to all designs
- **Add to Design**: for current design only (recommended)
- **Add to Profile**: local to the current test-bench inside the current design

*Note: 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).*

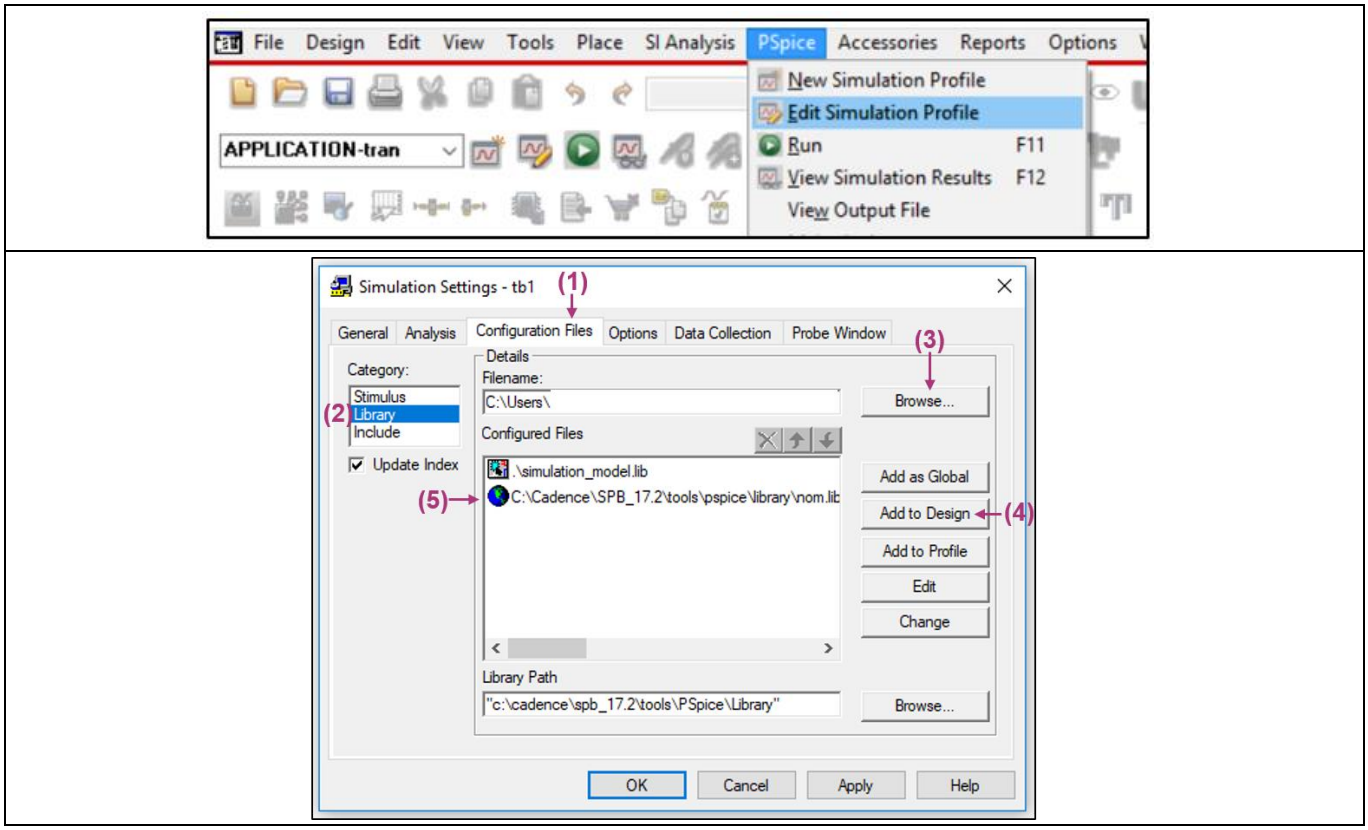


Figure 4 Import .lib file

2.2.2 Importing an .olb file

Figure 5 describes the following steps. 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)

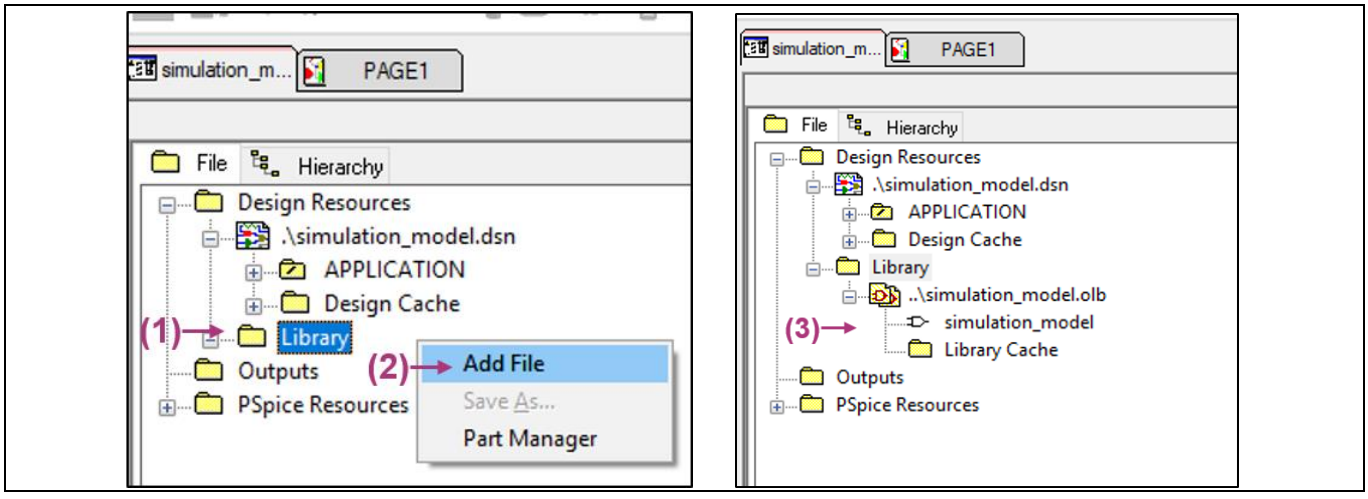


Figure 5 Import .olb file

Search in the **Place Part** sidebar (or press **"P"** on the keyboard) and place the symbol in the desired schematic (4), as shown in **Figure 6**.

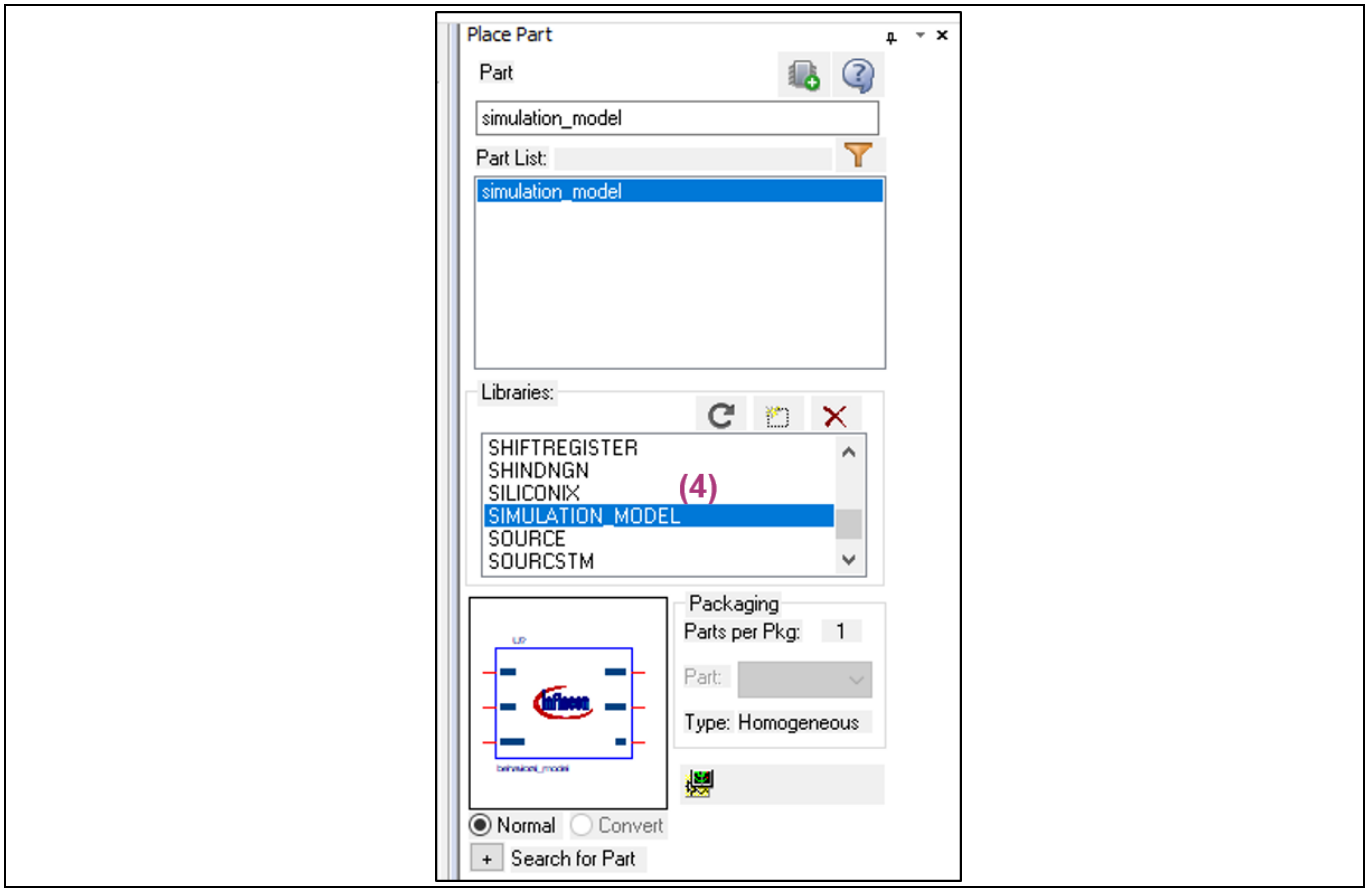


Figure 6 Place part

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:

As shown in **Figure 7**, from the main menu select **PSpice**, choose **New Simulation Profile**, set the name of the simulation profile and click on **Create (1)**.

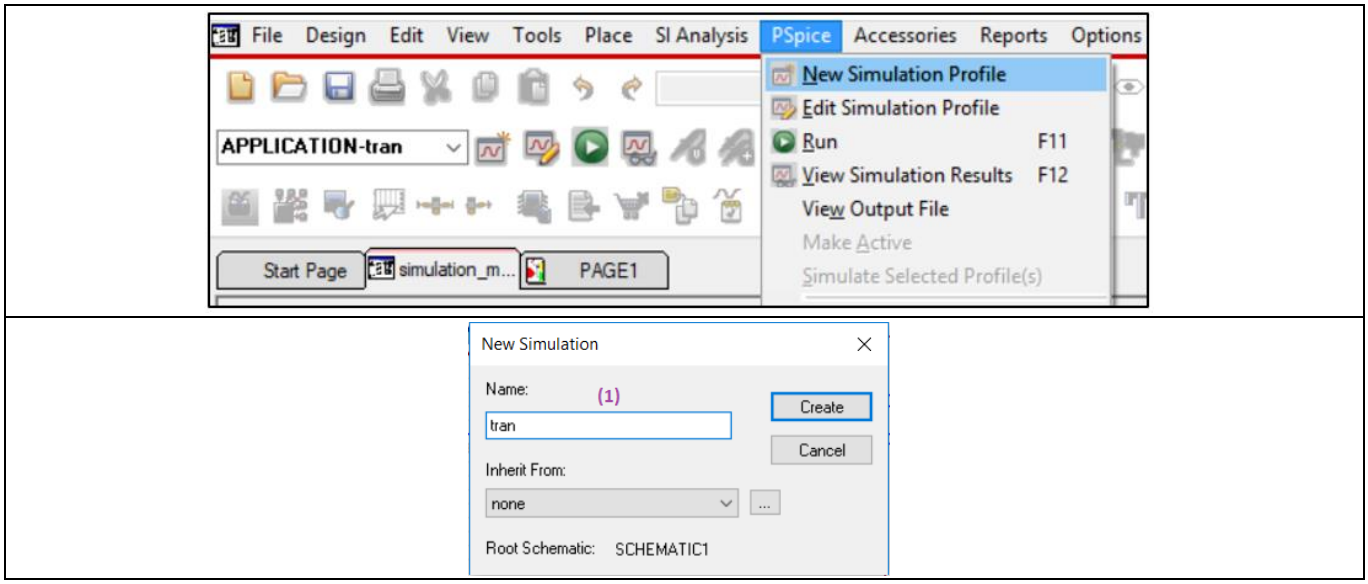


Figure 7 New simulation profile

Figure 8 shows the **Simulation Settings** dialog box that appears. 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

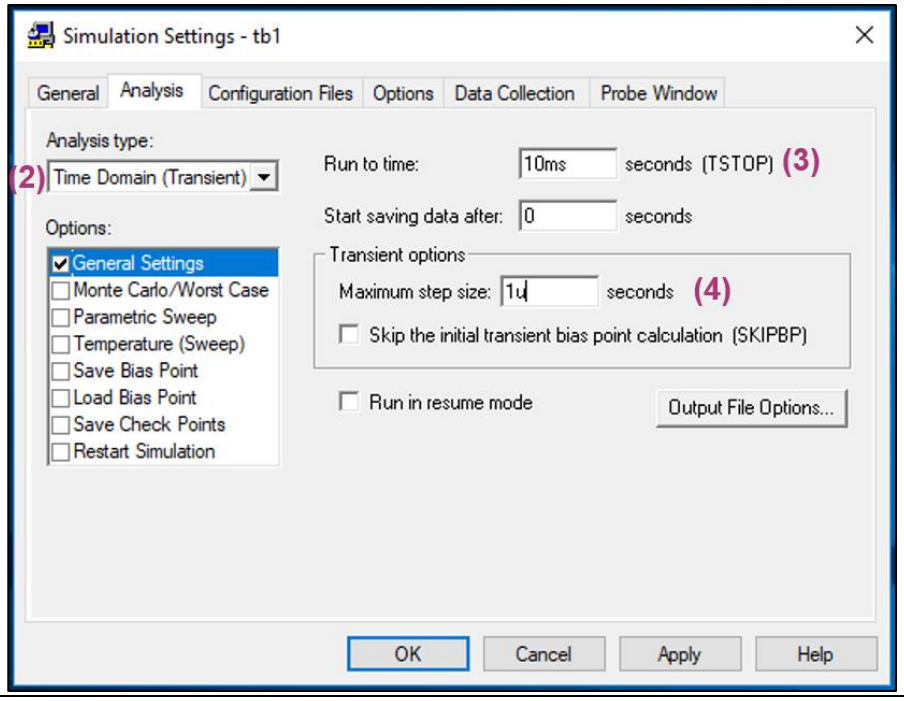


Figure 8 Analysis settings

As shown in **Figure 9**, under **Simulation Settings** go to **Options** (5) tab, select the category **Gate-level Simulation** (6) and then make sure that "**0**" is selected in the dropdown list of the **DIGINITSTATE** (7).

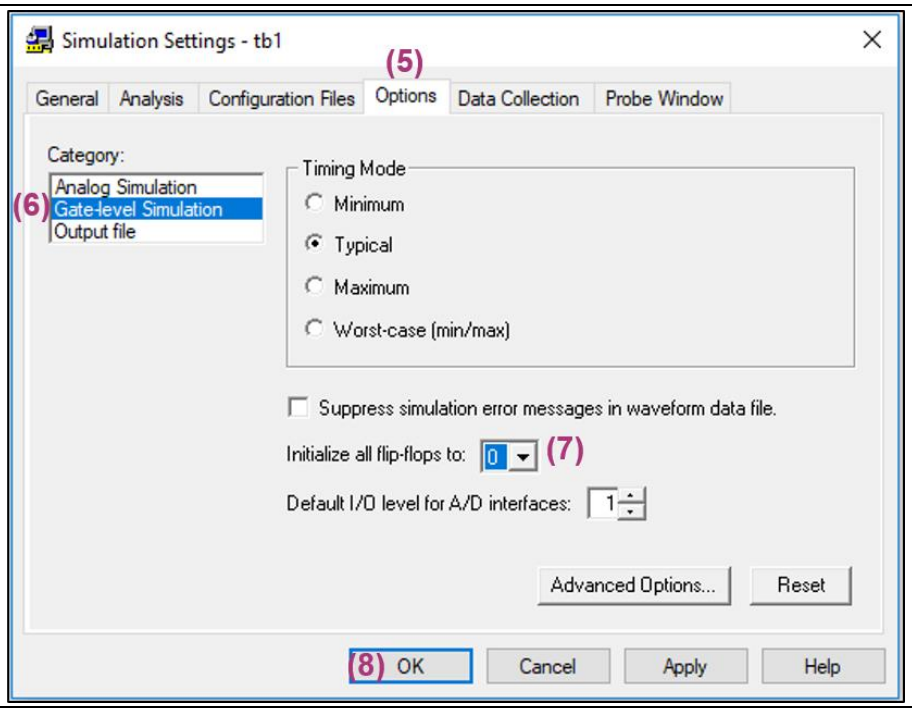


Figure 9 Options settings

Click **OK** to apply the settings and close the **Simulation Settings** dialog box **(8)**. To perform the analysis, press **Run** in the **PSpice** menu, as shown in **Figure 10**.

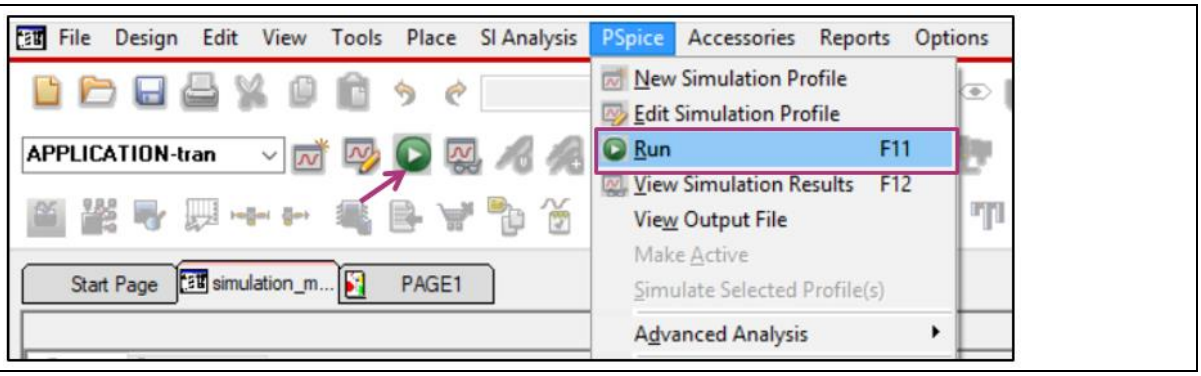


Figure 10 Run the simulation

2.4 Set up global parameters

A model parameter allows users to directly control specific components within any hierarchical level of the circuit, serving the following purposes:

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

Figure 11 shows how to define a global parameter in **Cadence OrCAD**. Follow the instructions given below:

- In the **Place Part** sidebar, find the instance **PARAM(1)**
- Select **PARAM** (from the library named "**SPECIAL**"), double click on it and place it on the schematic page **(2)**

*Note: If the "**SPECIAL**" library is missing, load it from **C:\Cadence\SPB_17.2\tools\capture\library\pspice\special.olb** as show in Chapter **2.2.2**.*

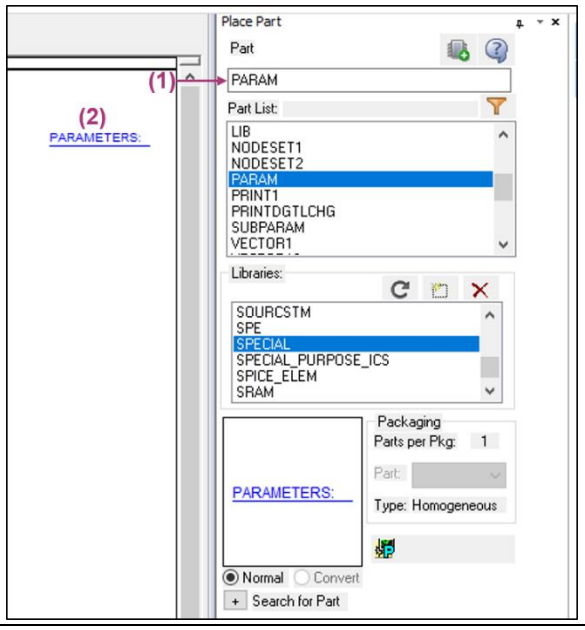


Figure 11 Global parameter

- Double click on **PARAMETERS** to start the spreadsheet editor
- As shown in **Figure 12**, click **New Property** (3), type a **Name** and **Value** and press **OK** (4)

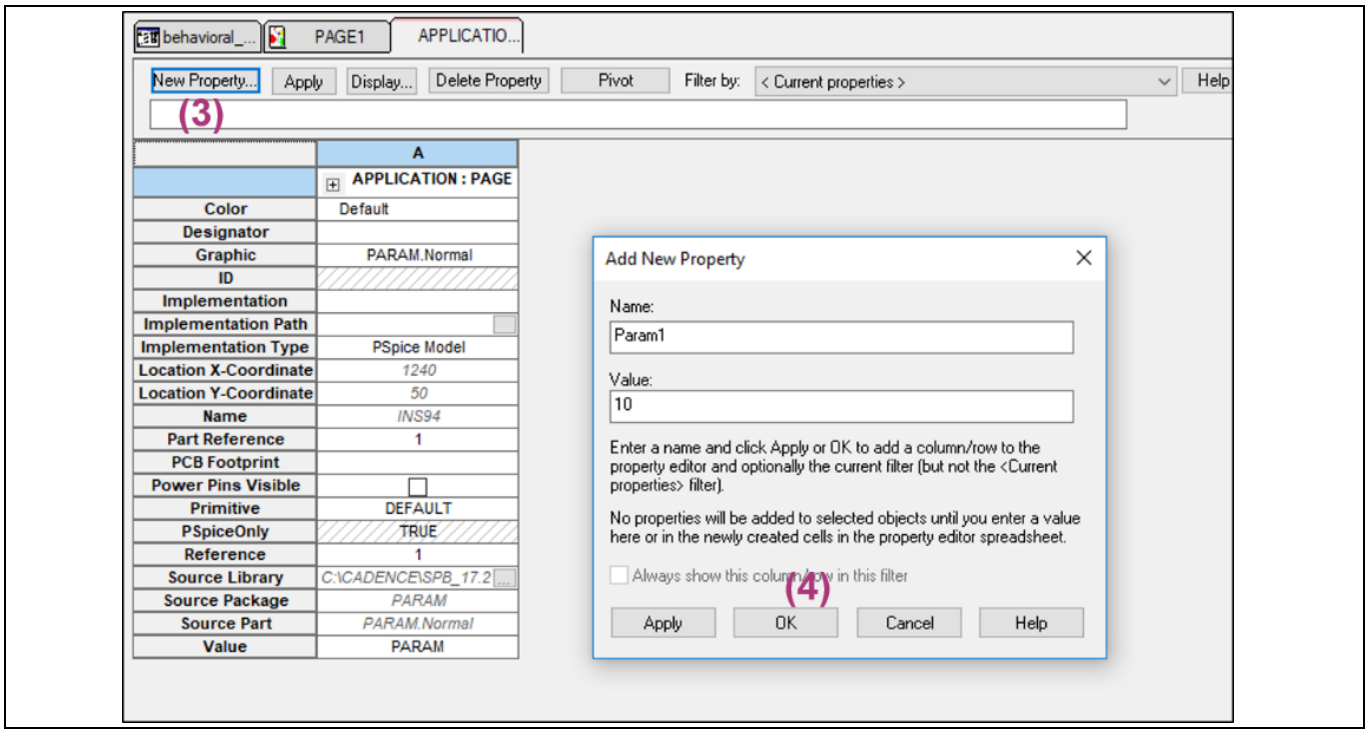


Figure 12 Add new parameter

- Right-click on **Param1** and, as illustrated in **Figure 13** choose the **Display option** (5). Select **Name and Value** (6) and click **OK** (7). This will result in showing the recently created global parameter on the test bench

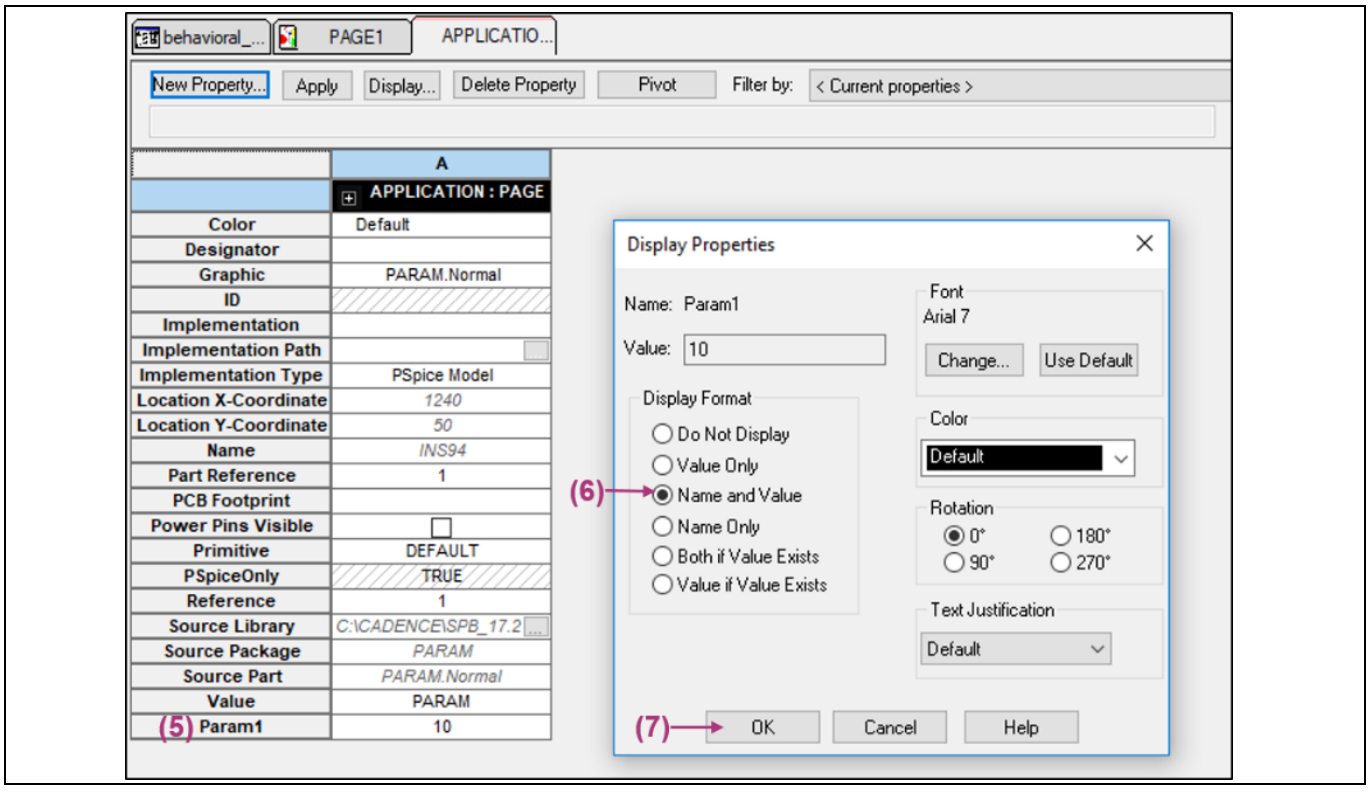


Figure 13 Display a global parameter

Two practical examples are shown below:

Figure 14 shows the use of global parameter for multiple instances. To apply the same value to multiple instances, use the parameter name between curly brackets within the value field of any component.

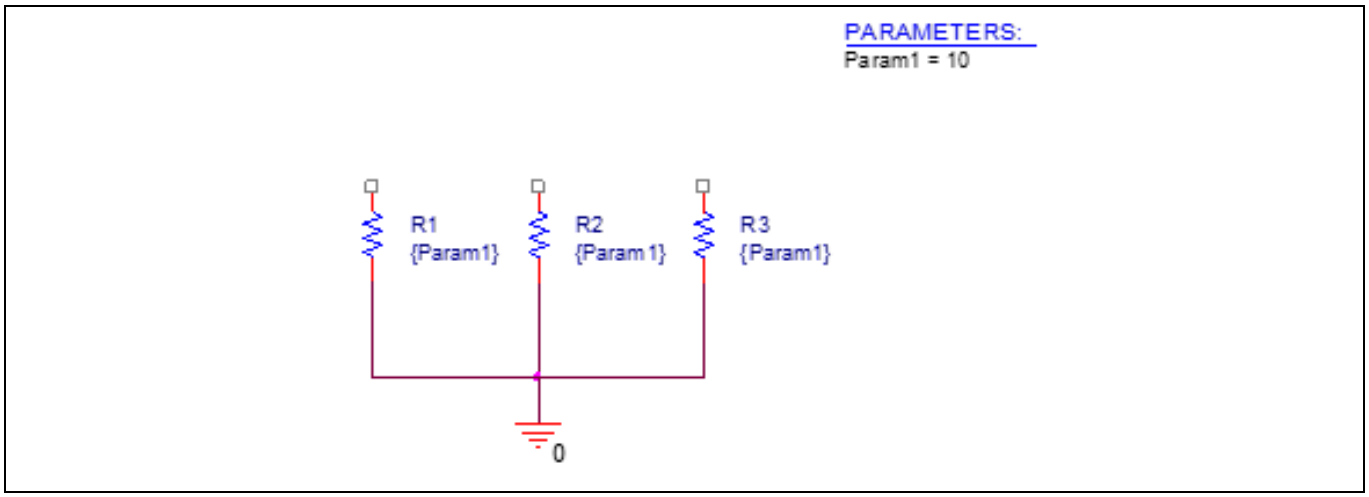


Figure 14 Global parameter for multiple instances

Figure 15 shows the steps required to set up and run a parametric simulation. Perform 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.

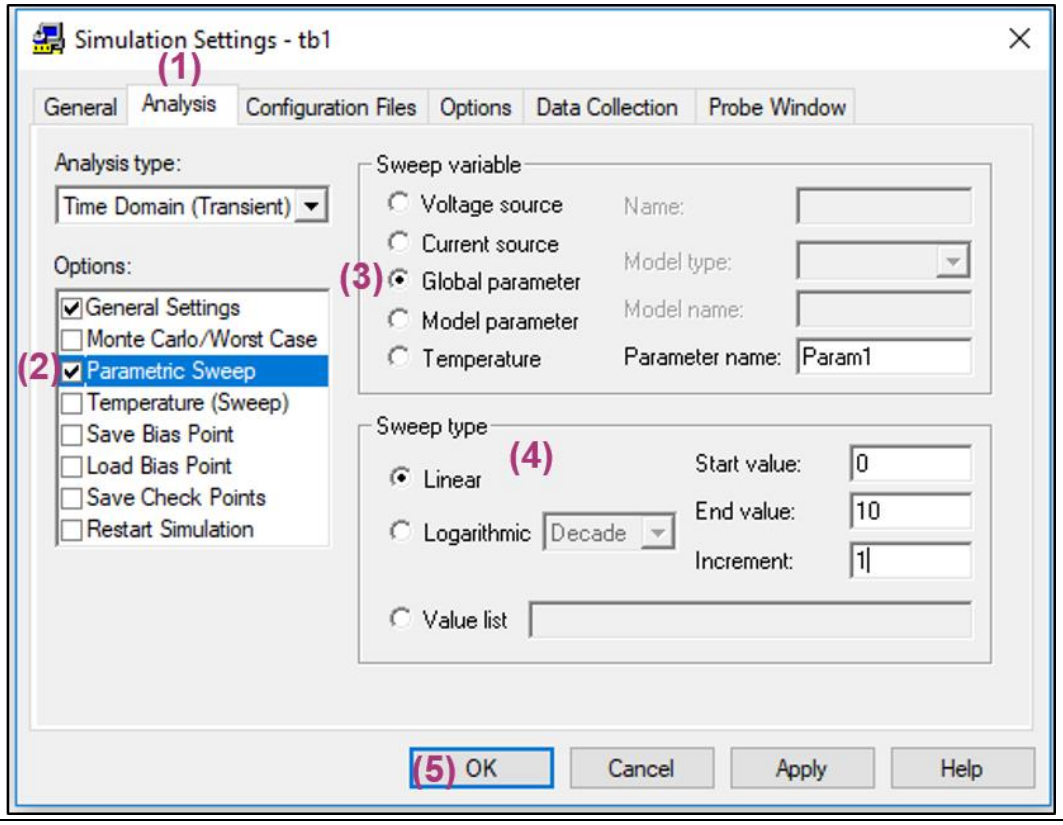


Figure 15 Set up a parametric simulation

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**) can be optimized for a specific design. **Figure 16** illustrates an example.

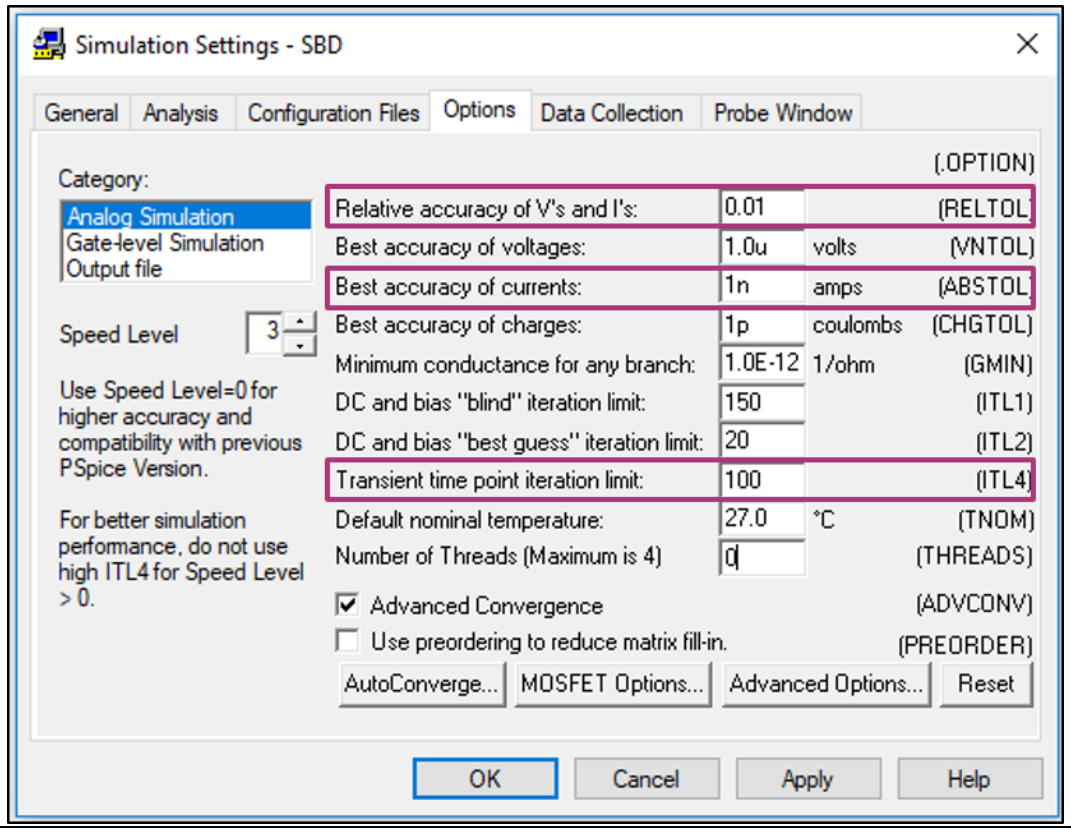


Figure 16 Simulation parameters

Table 1 below provides the recommended values to facilitate convergence.

Table 1 Recommended values to facilitate convergence

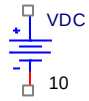
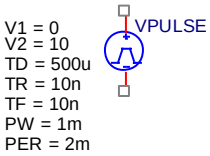
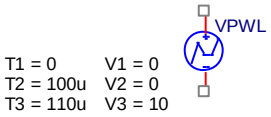
RELTOL=0.01	Relative accuracy of voltage and currents
ABSTOL=1nA	Maximum current accuracy
ITL4=100	Maximum number of iterations for transient analysis

The delivered models need to detect a rising edge starting from 0 V on inputs and supply voltages for a proper start-up sequence. It is recommended to use **VPWL** or **VPULSE** instead of **VDC** component.

Note: In order to prevent potential simulator convergence issues, avoid using voltage sources such as VDC components, as most models require a power-up pattern that starts from a zero-volt supply for at least a few microseconds.

Table 2 shows the recommended input and supply voltage sources. It is best-practice to use sources like **VPULSE** or **VPWL**.

Table 2 Input and supply voltage sources

VDC	VPULSE	VPWL
		
		

3 Opening an existing project

A simulation model is delivered with an attached test bench already configured and ready for use.

3.1 Steps to run the simulation:

Note: *A fully licensed version of **Cadence OrCAD** for Windows is required to be installed. Extract the files to C:\ drive.*

As shown in **Figure 17**, open the **OrCAD Capture CIS** application and from the **File** menu select **Open** → **Project.** In the opened window locate and open the **.opj** file package directory.

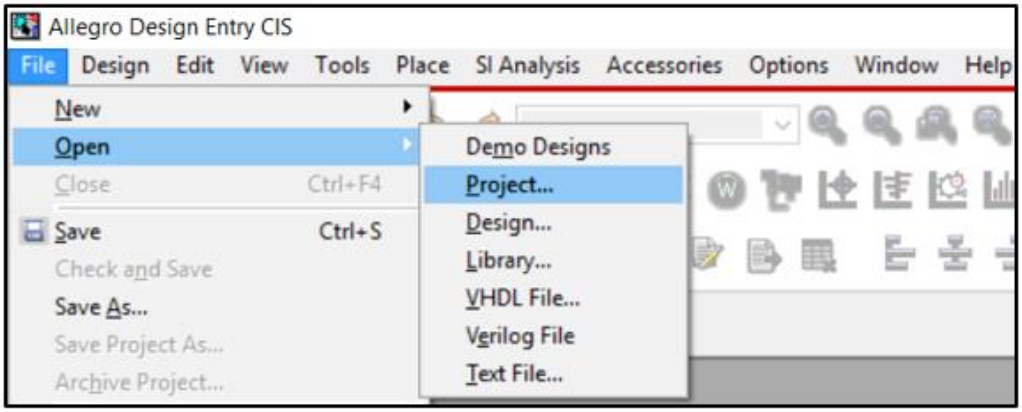


Figure 17 Open an existing project

Figure 18 shows the project manager that appears in the Pspice session frame whenever you open or create a project. Use the project file manager to collect and organize all the resources needed throughout the design flow. These resources include schematic design files (**(1)** and **(2)**), part libraries **(3)**, netlists, simulation models, simulation profiles **(4)**, stimulus files, and any other related information.

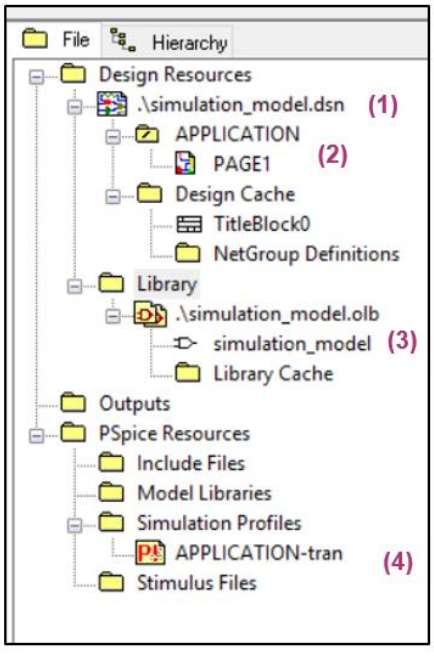


Figure 18 Project manager

As visible on **Figure 19**, Users can select from already available test benches (with included simulation profile and predefined waveforms probes).

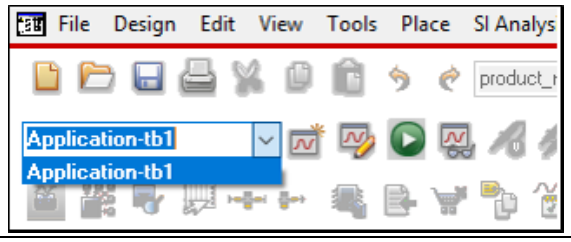


Figure 19 Select the application test bench

The simulation is started by pressing "F11" on the keyboard or by opening the **PSpice** menu and clicking **Run**. Alternatively, the **Play** button on the PSpice toolbar can be used, as illustrated in **Figure 20**.

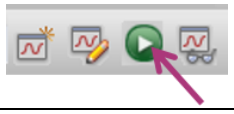


Figure 20 Start the simulation

3.2 Simulation results and measurements

Once the netlist has been generated the **"Allegro AMS Simulator"** (PSpice) will open and the simulation will automatically start. As **Figure 21** shows, a progress bar will be displayed in the bottom right corner **(5)**.

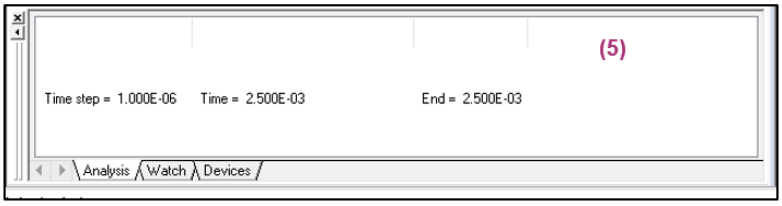


Figure 21 Simulation progress

After the simulation reaches 100%, the signals can be plotted. As shown in the **Figure 22** below, click on the **Trace** menu → **Add trace (6)**. Alternatively, it is possible to press the **Add trace** button (toolbox section) or **Insert** button (keyboard). As visible in **Figure 23**, the respective signals need to be selected from the list to plot them. After the selection is done press the **OK** button **(7)**.

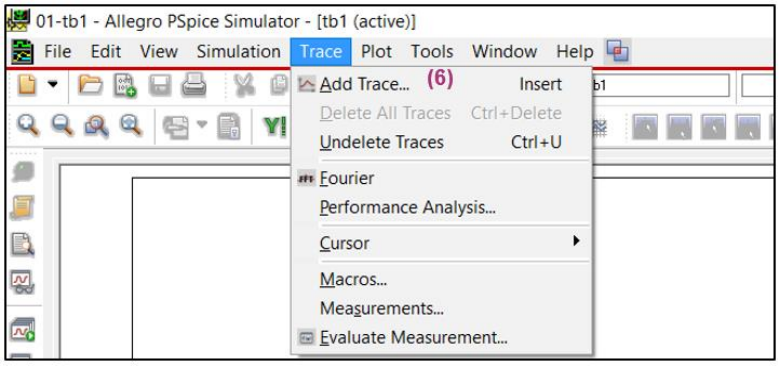


Figure 22 Plot signals

*Note: The desired signals can be filtered by using the check boxes in the center of the window according to their type (e.g. voltages, currents, power, etc.). **(8)**). Signals can also be composed by selecting the appropriate functions available in the right list "**Functions or Macros**" **(9)**.*

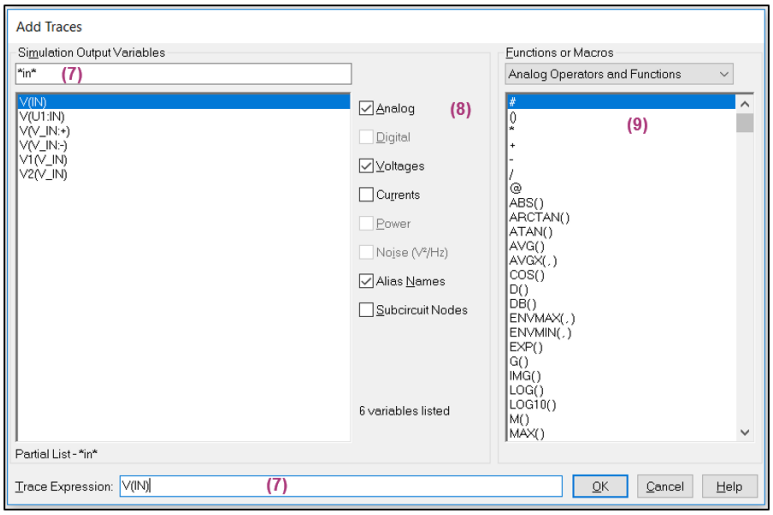


Figure 23 Plot signals

Figure 24 below explains how to add a new plot by clicking **Plot** → **Add Plot to Window**.

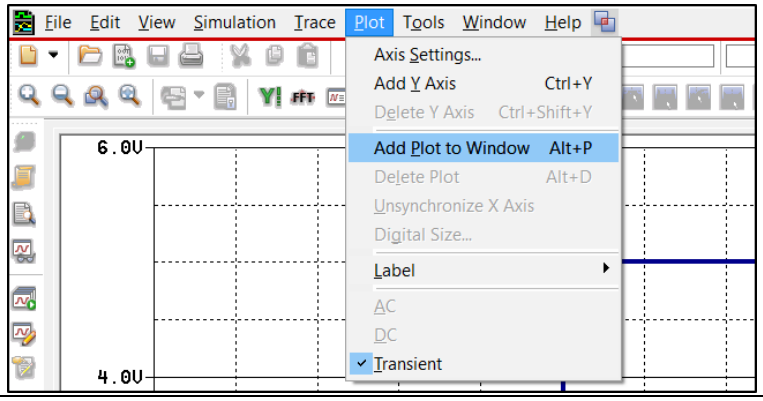


Figure 24 Add a new plot

See **Figure 25** for adding of cursors for signal value measurement by choosing **Trace** → **Cursor** →**Display**. Alternatively, this can be done by a left-click onto the **Display Cursors** button (toolbox).

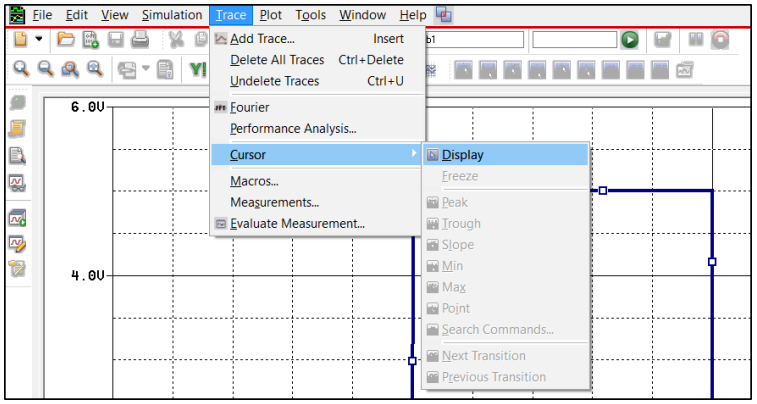
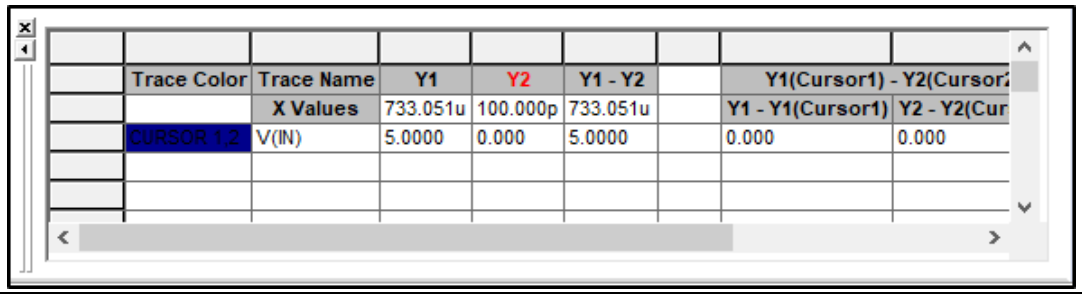


Figure 25 Add cursors

Figure 26 shows an example of a table measurement menu, which is observable in the bottom right corner of the GUI.



	Trace Color	Trace Name	Y1	Y2	Y1 - Y2		Y1(Cursor1) - Y2(Cursor2	
		X Values	733.051u	100.000p	733.051u		Y1 - Y1(Cursor1)	Y2 - Y2(Cur
	CURSOR 1,2	V(IN)	5.0000	0.000	5.0000		0.000	0.000

Figure 26 Measurement values

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Revision history

Document version	Date of release	Description of changes
01.00	2021-08-04	Initial release

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