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How to Import Third-Party Models into LTspice

This article presents a step-by-step process for importing two types of third-party SPICE models into LTspice: models implemented with .MODEL directives and those implemented with .SUBCKT blocks.

LTspice makes it easy to create and simulate schematics quickly. Sometimes the best starting point for hashing out a design is to use ideal circuit elements. However, a circuit designer will need to improve the initial simple schematic with more realistic component models.

LTspice ships with an extensive collection of third-party manufacturer models. To use one of these models, right-click the component, then click the **Pick…** or **Select** button in the properties window and select one of the models listed *(Fig. 1)*.

For devices that aren't included in the LTspice component library, a model from an external source can be imported into LTspice. The steps required to accomplish this will vary depending on the device type and the model syntax.

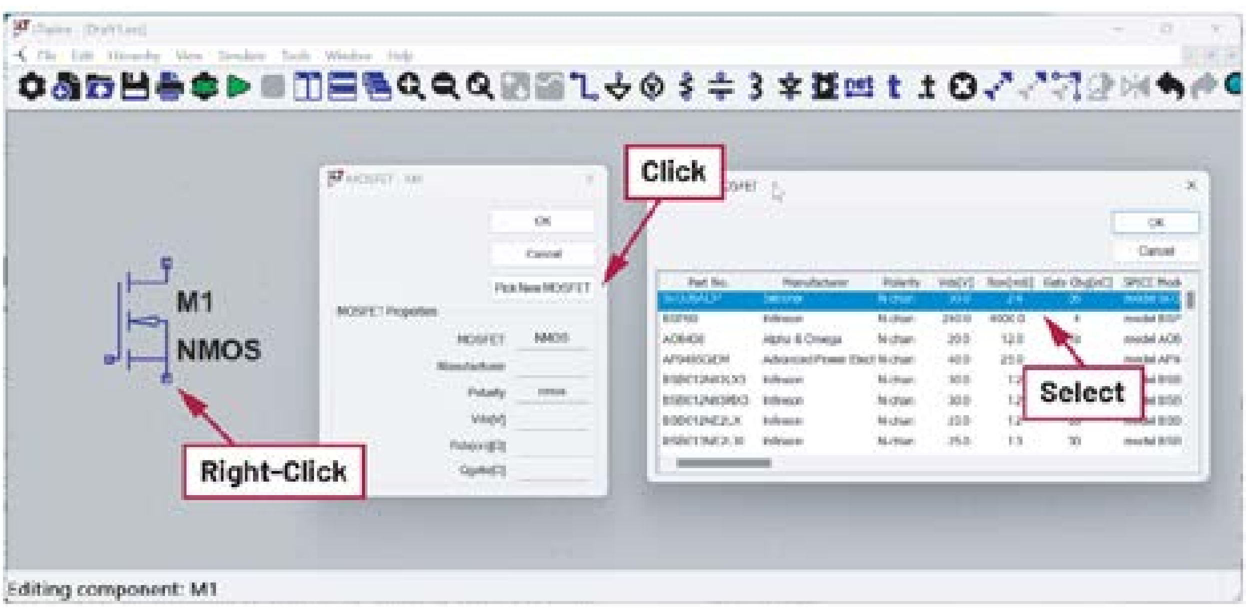
There are two flavors of SPICE models: circuit behavior defined by a **.MODEL** directive and circuit behavior defined by a **.SUBCKT** directive. This article will provide guidance on importing both model types.

Note: If the imported model file is encrypted, it may be difficult to determine if the model was implemented with **.MODEL** or **.SUBCKT** directives. Contact the model vendor for support with encrypted models or post your issue on the LTspice EngineerZone forum; someone in the EZ community might be able to help.

Each of the examples below is included in the LTspice-importing-third-party-models.zip file available for download here.

Importing a .MODEL Directive

For a device that's modeled with a **.MODEL** directive, importing that model into LTspice is a fairly simple process.



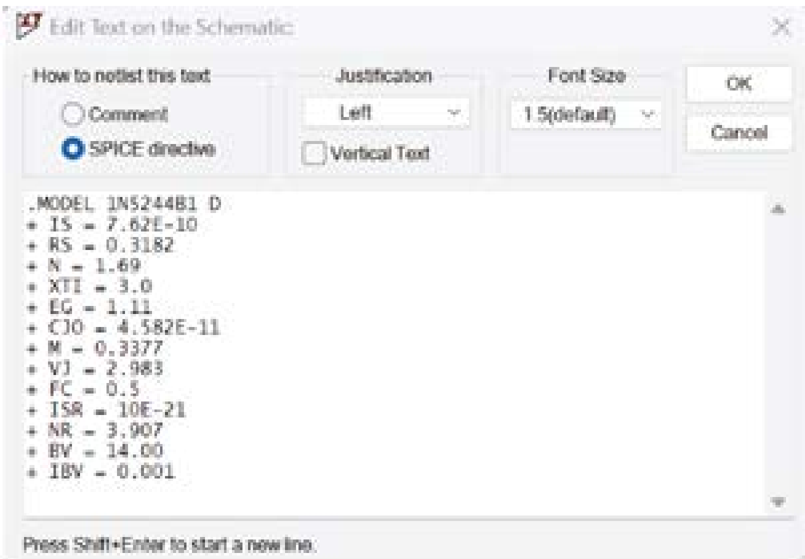
1. Using the NMOS model in the LTspice component library.

A **.MODEL** directive is a single line of code that contains the device name, device type, and parameter values for that model. Some models might be fairly simple and idealized, such as:

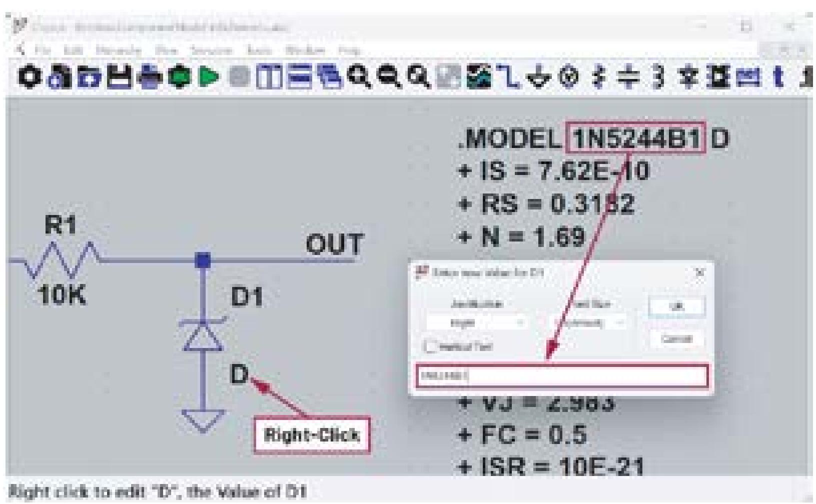
```
.MODEL MyIdealDiode D(Ron=.1 Roff=1Meg
Vfwd=.4)
```

Manufacturer-provided models are going to be more complex. For example:

```
.MODEL 1N5244B1 D(IS=7.62E-10, RS=0.3182,
+ N=1.69, XTI=3.0, EG=1.11, CJO=4.582E-11,
+ M=0.3377, VJ=2.983, FC=0.5, ISR=10E-21,
+ NR=3.907, BV=14.00, IBV=0.001)
```



2. Adding a .MODEL directive directly to a schematic.



3. Setting the component symbol value to point to the .MODEL name.

This example is a single line of code. The + character indicates to LTspice that this line is a continuation of the previous line.

See the help topic for the **.MODEL** directive in the LTspice manual for more information and related model parameters. In the LTspice menu, select **Help** > **LTspice Help** to access the LTspice manual.

Embedding a .MODEL Directive Directly in the Schematic

One option is to embed the **.MODEL** statement directly in the schematic. To add a SPICE directive to your schematic, select **Edit** > **SPICE Directive** from the menu, or type **. (period)** to bring up the **Edit Text on the Schematic** dialog. Copy and paste the **.MODEL** statement into the input field, click **OK**, and place the text on the schematic *(Fig. 2)*.

The next step is to add a component symbol to your schematic and ensure it points to your newly placed **.MODEL** directive. In this example, the 1N5244B1 is a Zener diode. Place a Zener diode by selecting **Edit** > **Component** from the menu and select **zener** from the list. Click on the schematic to place the component symbol. Choose a generic symbol for this — don't select an ADI part. For example, if you need to import an op-amp model, use the "opamp2" component symbol rather than the AD822.

To make the connection between the component symbol and the **.MODEL** directive, right-click on the component value field. The default value is a placeholder value of "D" when the component is first placed. Enter the model name into the **Enter New Value** dialog. For this example, the model name is **1N5244B1** *(Fig. 3)*.

Refer to the schematic named **intrinsic_model_embedded.asc** in the zip file to explore this example further.

Importing a .MODEL Directive from a Text File

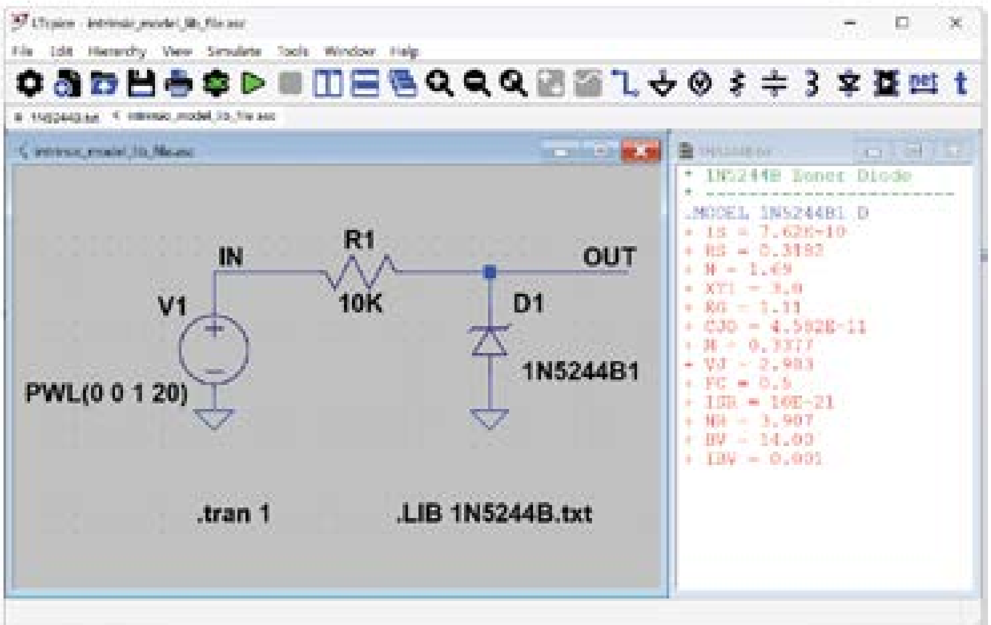
Another option for using a **.MODEL** directive is to have a separate text file that contains the model information. Keeping the model information in a file minimizes the clutter on the schematic. This is especially helpful if the model is long and complex.

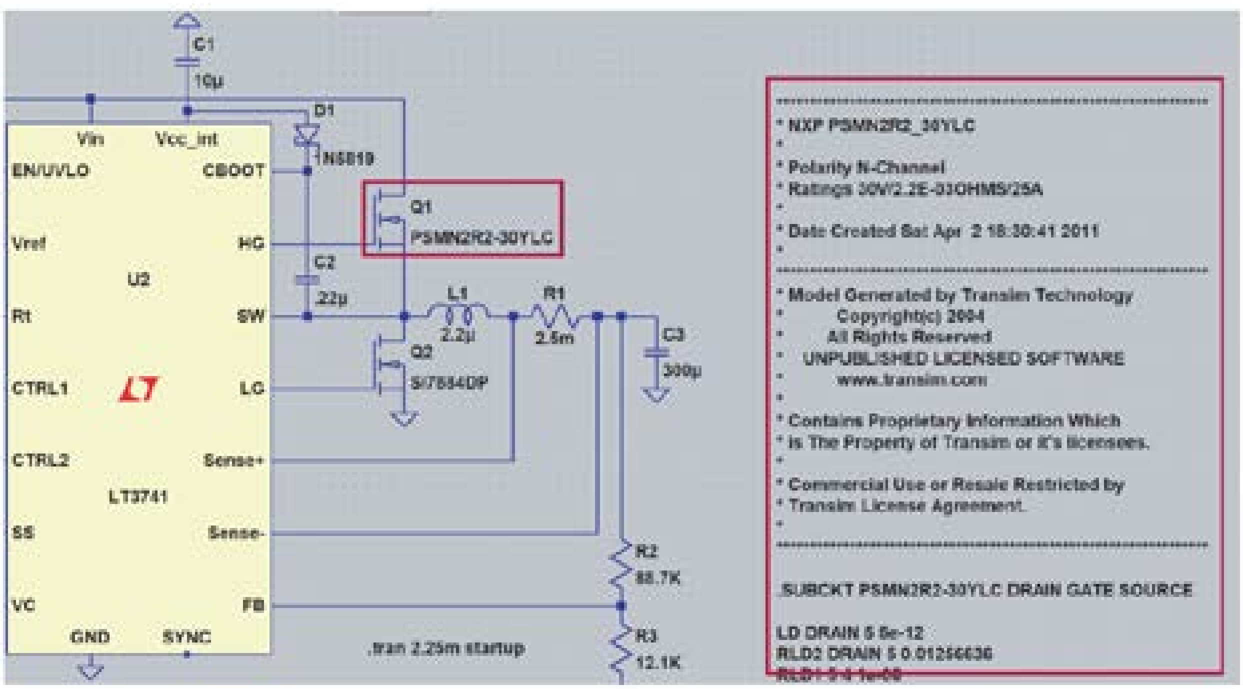
The simplest way to accomplish this is to ensure that the model text file is in the same directory as the schematic and import the contents of the file with a **.LIB** directive. Add the **.LIB** directive by selecting **Edit** > **SPICE Directive** from the menu or typing **. (period)** to bring up the **Edit Text on the Schematic** dialog. If the model file is in the same directory as the schematic file, you can import the file by typing **.LIB <filename>**. For this example, the filename is **1N5244B.txt**.

Make the link between the component and the model name using the method described in the previous section. In this example, the model name is **1N5244B1** *(Fig. 4)*.

Note that the filename and the name of the model contained in the file may not be the same, as in this example. In addition, a single file could have multiple model directives, so be sure to refer to the model name (and not the file name)

4. Using a .LIB directive to import models from a file.





5. Using a standard LTspice symbol to refer to an imported .SUBCKT model.

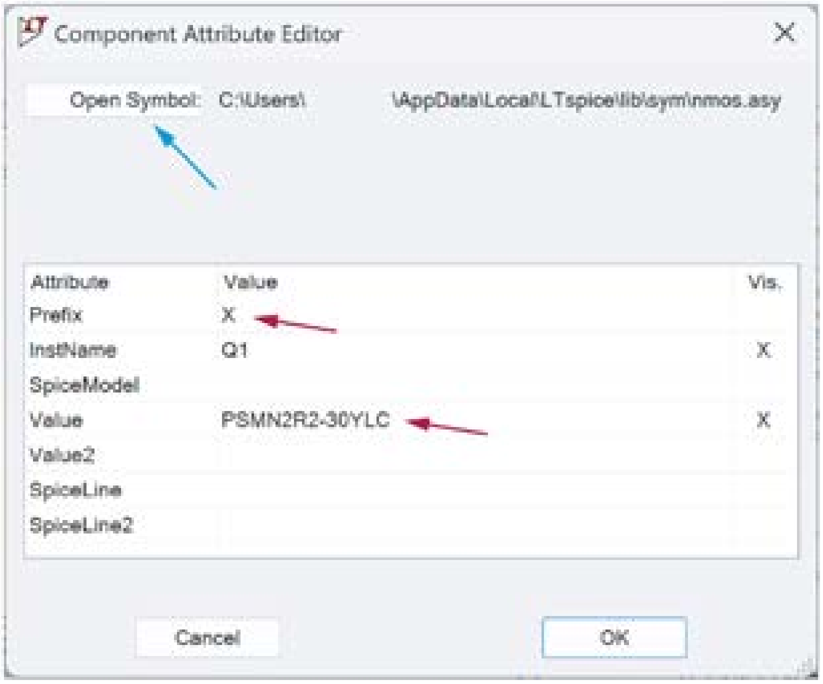
in the component value.

Refer to the file named **intrinsic_model_lib_file.asc** to explore this example further.

Importing a .SUBCKT Model

The method of including a **.SUBCKT** model into your schematic is identical to what was required to include a **.MODEL** directive as previously described. Either copy and paste the contents of the model into the schematic as text using **Edit** > **SPICE Directive**, or use a **.LIB** statement to pull the contents of the subcircuit definition file into your schematic.

Placing and connecting a component symbol to your imported **.SUBCKT** model is a bit different than the steps that were required for an imported **.MODEL** directive. It will be described in the following sections.



6. Setting symbol Prefix and Value to point to .SUBCKT model.

Using a .SUBCKT Model: Reusing an Existing Symbol

If the **.SUBCKT** model is a good match for one of the standard symbols already in the LTspice library, it's light work to point one of those symbols to the imported **.SUBCKT** model.

Using a **.SUBCKT** model and an existing schematic as a starting point, the steps needed to change the Si7884DP NMOS devices in this schematic with an imported model for the NXP PSMN2R2-30YLC are detailed further down. This model has been provided as a **.SUBCKT** file, PSMN2R2_30YLC.txt, with the following header information:

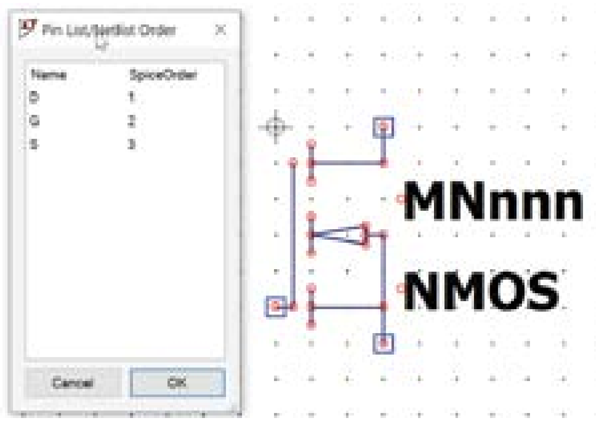
```
.SUBCKT PSMN2R2-30YLC DRAIN GATE SOURCE
```

PSMN2R2-30YLC is the model name, followed by the pin names DRAIN, GATE, SOURCE. The order of the pin names matters — more on that later.

Since this is an NMOS device, it's easiest to reuse the NMOS symbol in the LTspice library. Place an NMOS device by typing **P** (or selecting **Edit** > **Component**), selecting **nmos** from the list, clicking **Place**, and clicking on the schematic to place the NMOS symbol.

Figure 5 shows the example schematic where Q1 is pointing to an imported **.SUBCKT** model correctly. Notice the model name **PSMN2R2-30YLC** has been assigned to the value of Q1.

The example schematic already has Q1 set up to point to the imported PSMN2R2-30YCL model; the steps required to connect Q2 to this same model are detailed below. Open



7. Verifying the pin order of a symbol using the pin table in the symbol editor.

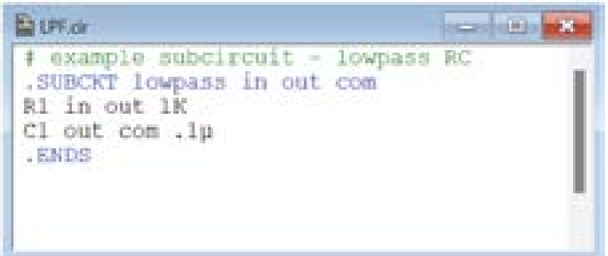
the **subckt_with_included_symbol.asc** example schematic to replicate the following steps.

To connect the **.SUBCKT** model to Q2, **CTRL + right-click** on Q2 to open the **Component Attribute Editor**. Change **Value** to **PSMN2R2-30YLC**, which matches the subcircuit name in the header of the model.

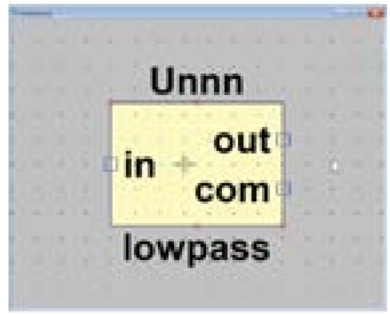
Important: Change the Prefix to X

Next, change the prefix to **X**, which is necessary when connecting a **.SUBCKT** model to a symbol *(Fig. 6)*. This is an additional step that wasn't required when importing a **.MODEL** directive.

To confirm that the pin order in the NMOS symbol in the LTspice library matches the imported model, click the



8. The .SUBCKT model for a simple RC filter.



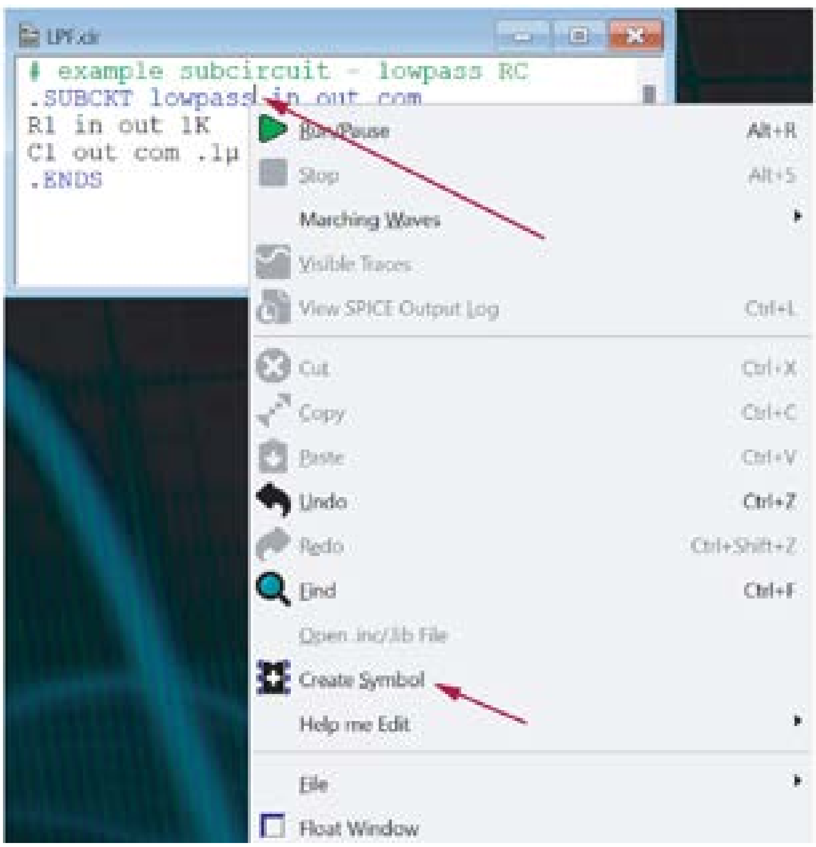
10. A newly autogenerated symbol.

Open Symbol button in this dialog. This will open the symbol editor. Select **View** > **Pin Table** to show the pin order *(Fig. 7)*. This confirms that the pin order of DRAIN, GATE, SOURCE matches the order in the PSMN2R2-30YLC **.SUBCKT** definition.

Using a .SUBCKT Model: Creating a New Symbol

If a **.SUBCKT** model isn't a good fit for an existing symbol, you can use LTspice to autogenerate a new symbol to go along with the subcircuit. **LPF.cir** is provided in the resources as a simple example *(Fig. 8)*.

Right-click on the **.SUBCKT** name — lowpass in this example. Select **Create Symbol** and click **Save**. Be sure to save the new symbol to the same directory as the model file *(Fig. 9)*.



9. Creating a symbol for a .SUBCKT model.

This will create an autogenerated symbol. This new symbol will open automatically in LTspice *(Fig. 10)*.

Remove the Hardcoded Model Path from the Symbol Attributes

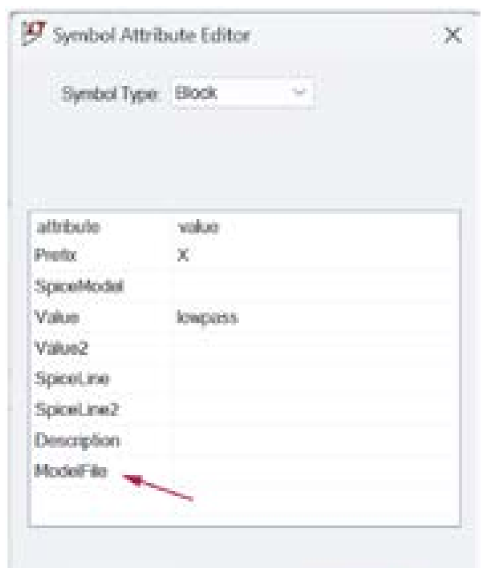
With the new symbol open in LTspice, right-click on the symbol and select **Attributes** > **Edit Attributes**. Delete any path information that has been added to the **ModelFile** attribute to improve the portability of this symbol. Click **OK**, then click **Save**.

Be sure to include the **.SUBCKT** model in your schematic, either with the **.LIB** directive or as text directly in the schematic. See *Figure 11* showing how to embed the **.SUBCKT** block directly in the schematic.

Editing a Newly Created Symbol

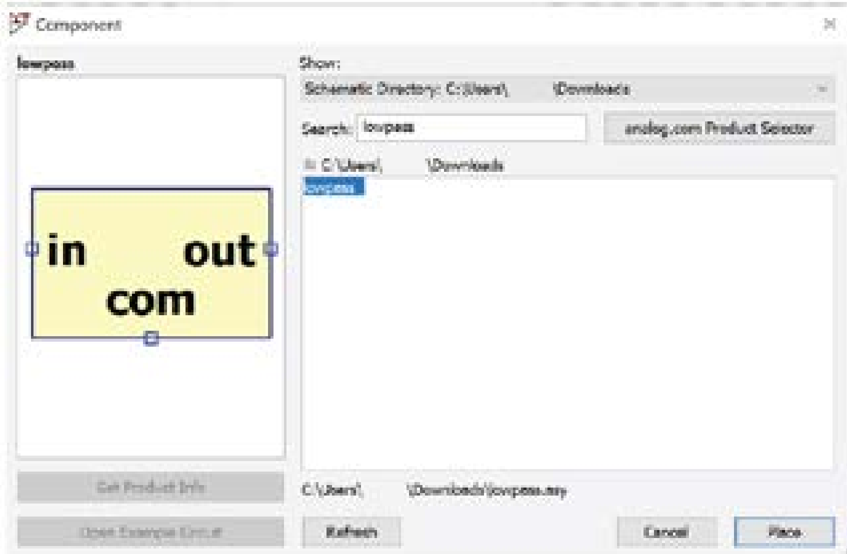
Now that there's a new symbol, you can edit it to better reflect the functionality of the model. Some simple tweaks with the **Move** tool (press **M** or select **Edit** > **Move**) will allow you to rearrange the pins to more sensible locations.

Placing the New Symbol in a Schematic



11. Removing hard-coded path information to improve the portability of a new symbol.

Ensure that the symbol file (.asy) and associated subcircuit file (.cir) are in the same directory as the schematic file (.asc). To place the new symbol in a schematic, type **P** (or **Edit** > **Component**) to open the **Component** dialog. Select **Schematic Directory** from the directory drop-down and select the newly created symbol *(Fig. 12)*. Click **Place** and click on the schematic to place the symbol *(Fig. 13)*.



12. Locating the newly created symbol in the schematic directory.

Sharing Simulation Files with Custom Symbols and Models

When sharing this schematic with others, ensure that all files including the schematic (.asc), the symbol (.asy), and any files pulled in with a **.LIB** directive are zipped up in the same directory.

Conclusion

Many realistic device models are already included in LTspice, but importing third-party models gives flexibility to incorporate a wide variety of models available from component vendors. The steps outlined in this article provide the guidance needed to build a working schematic that can be easily shared with others.

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Michael Potts joined ADI in 2022 as a staff field applications engineer. Prior to ADI, he spent nearly 20 years designing embedded systems for broadcast audio communications, video, and radar products for automotive traffic monitoring, and a wide variety of medical devices. He received his BSEE from the University of Wisconsin-Platteville.

13. Using the newly created symbol in a schematic.