



*Document can be found at <http://www.motorola.com/rf/models>
Go to MET and Root LDMOS Models for Agilent's ADS v2002,
Release Notes and Installation Instructions*

Release Notes and Installation Instructions for

Agilent's Advanced Design System LDMOS Discrete Parts Design Kit Release v2002cp0803

REV 0

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I. Introduction

This current release of the LDMOS Discrete parts library for ADS v2002c is implemented as an ADS Design Kit and should be installed according to Agilent's instructions on installing design kits.

Also, notice that there is only one zip file for all the major platforms which we support (Microsoft Windows 2000, NT 4.0, Solaris 2.7/2.8 and HP-UX 11.0/11.11). This is due to the fact that ADS v2002c allows for the use of dynamically-linked or shared-object libraries for distribution of user-compiled models. We are no longer required to provide a new simulator executable with our models linked in for each computing platform.

Next, the design kit was implemented per Agilent's instructions contained in the Design Kit Development Manual dated September 2002. Therefore, the structure of our library has been modified per Agilent's requirements so that in the future Agilent can help support installation and simulation issues. Because of this modification, we were forced to use a new element called the TechInclude (See Release Notes, TechInclude element). The TechInclude is required now on all top-level schematics for simulation purposes.

Lastly, the library has gone through several content changes. First, some parts have changed names and several new parts have been added to the library. Also, others have been cancelled and can only be simulated using a new "Cancelled" version of the element. There is a list of parts which have been moved from the bulk availability into tape and reel availability only along with parts which have been migrated from the "S" to the "LS" or low gold configurations. Please read the Release Notes section of this document for detailed library release information.

The Motorola RF LDMOS Modeling Team highly recommends that you read through this document thoroughly to enable a smooth installation and transition to the new release.

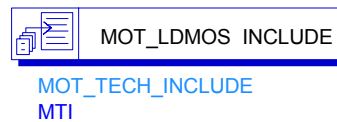
II. Release Notes

A. TechInclude Element

Due to the change from a totally customized library to an ADS Design Kit, we were required to add a TechInclude element. For this and future releases, the user is required to place the MOT_TECH_INCLUDE element at the top-level of all designs where simulation is performed. ADS will only allow the user to place one TechInclude element on any one design. If the user does not place the TechInclude element at the top-level or places it within a sub-circuit, a simulation error will occur such as the following:

Error detected by HPEESOFSSIM during netlist parsing
 `MRF1` is an instance of an undefined element ...

The MOT_TECH_INCLUDE element is now the fifth element in the Motorola LDMOS Model Library palette and looks like the following when placed in a schematic:



For more examples of using the TechInclude element, please download the customer example project from the website and go through the customer project read-me part of this document.

B. New Parts Added to the library

The following table contains the new parts which have been added to the LDMOS Discrete Parts Design Kit v2002cp0803 release.

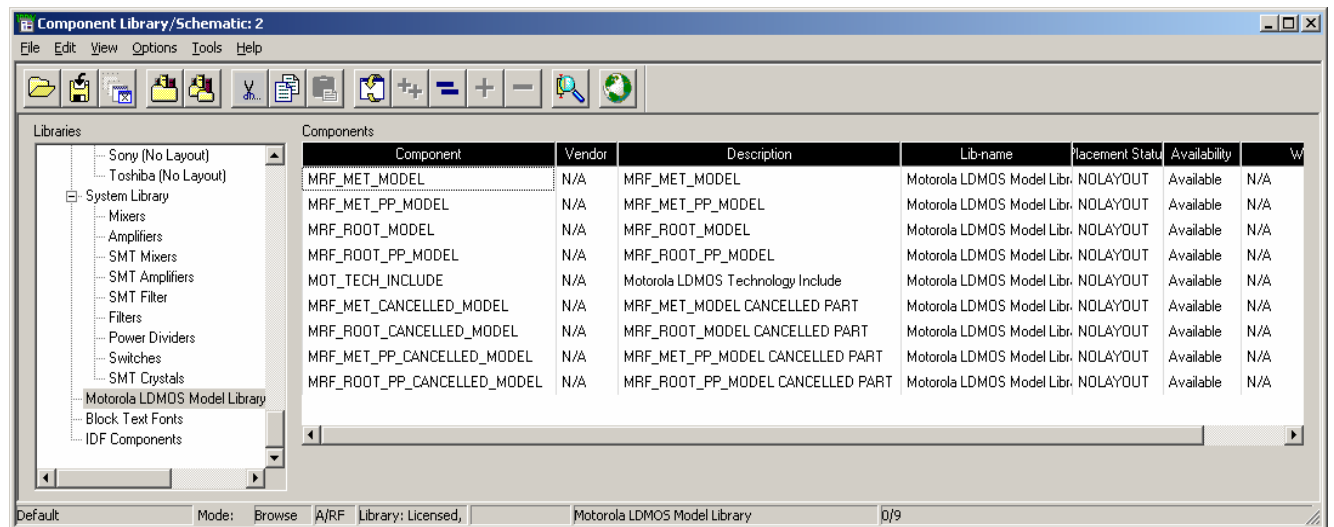
| | | |
|---------------|----------------|--------------|
| MRF372 | MRF5P20180R6 | MRF5S21130 |
| MRF373ALSR1 | MRF5P21180R6 | MRF5S21130S |
| MRF373AR1 | MRF5S19090LR3 | MRF5S21150 |
| MRF374A | MRF5S19090LSR3 | MRF5S21150S |
| MRF18060ALSR3 | MRF5S19100LR3 | MRF5P21240 |
| MRF18060BLSR3 | MRF5S19100LSR3 | MRF5P21240R6 |
| MRF19085LSR3 | MRF5S19030 | MRF9060MBR1 |
| MRF21060SR3 | MRF5S19030S | MRF9060MR1 |
| MRF21085LSR3 | MRF5S19150 | MRF9135L |
| MRF21085SR3 | MRF5S19150S | MRF9135LSR3 |
| MRF21120R6 | MRF5S21090L | MRF9180R6 |
| MRF21180R6 | MRF5S21090LSR3 | MRF9130L |
| | MRF5S21100LR3 | MRF9130LSR3 |
| | MRF5S21100LSR3 | |

C. Cancelled Parts

The following list of parts have been labelled as cancelled:

| MET Models | Root Models |
|-----------------|-----------------|
| MRF182, MRF182S | MRF182, MRF182S |
| MRF183, MRF183S | MRF183, MRF183S |
| MRF185 | MRF184, MRF184S |
| MRF9180S | MRF185, MRF186 |
| MRF18090AS | MRF187, MRF187S |
| MRF19120S | MRF286, MRF286S |
| MRF19125S | MRF9180S |
| MRF21120S | MRF18090AS |
| MRF21180S | MRF19120S |
| | MRF19125S |
| | MRF21120S |
| | MRF21180S |
| | MRF6522_10R1 |
| | MRF6522_5R1 |
| | MRF6525_10R1 |
| | MRF6525_5R1 |

If you have these part names referenced in existing designs and still have a need to use these, you will need to replace MRF_MET_MODEL/MRF_ROOT_MODEL elements with MRF_MET_CANCELLED_MODEL/MRF_ROOT_CANCELLED_MODEL elements, along with the MRF_MET_PP_MODEL/MRF_ROOT_PP_MODEL elements with MRF_MET_PP_CANCELLED_MODEL/MRF_ROOT_PP_CANCELLED_MODEL. The 'Cancelled' version of these parts can *only* be found in the Component Library Browser under the Library Heading of Motorola LDMOS Model Library.



D. Part Name Changes

If you have designs using the old name, you will have to select the new nomenclature for simulations to run correctly.

Listed below are the part names which have been offered as an “S” version part in the previous release of the library. These part names have been migrated to the low gold version of the part which has been added to this library release, indicated by the “LS” prefix in the part name. These parts are offered only in the tape and reel formats, indicated by the R1 and R3 prefixes in the table below.

1. Migrated “S” Parts

| Previous Part Name | New Part Name |
|--------------------|---------------|
| MRF9045S | MRF9045LSR1 |
| MRF9060S | MRF9060LSR1 |
| MRF9080S | MRF9080LSR1 |
| MRF18085AS | MRF18085ALSR3 |
| MRF18085BS | MRF18085BLSR3 |
| MRF284SR1 | MRF284LSR1 |
| MRF21010S | MRF21010LSR1 |

The part names in the table below are parts which are no longer offered in bulk, but are currently available in the tape and reel formats.

2. Tape and Reel Only Parts

| Previous Part Name | New Part Name |
|--------------------|---------------|
| MRF9045 | MRF9045R1 |
| MRF9060 | MRF9060R1 |
| MRF18060AS | MRF18060ASR3 |
| MRF18060BS | MRF18060BSR3 |
| MRF19030 | MRF19030R3 |
| MRF19030S | MRF19030SR3 |
| MRF19045 | MRF19045R3 |
| MRF19045S | MRF19045SR3 |
| MRF19085S | MRF19085SR3 |
| MRF19060S | MRF19060SR3 |
| MRF284 | MRF284R1 |
| MRF21010 | MRF21010R1 |
| MRF21030 | MRF21030R3 |
| MRF21030S | MRF21030SR3 |
| MRF21045 | MRF21045R3 |
| MRF21045S | MRF21045SR3 |

III. Design Kit Installation

A. Download Design Kit

This section outlines the procedures necessary to install the new LDMOS Discrete Parts Design Kit v2002cp0803 into ADS v2002c. First, download the ADS_MOT_LIBRARY_v2002cp0803.zip from our website to your computer by right-clicking on the file link and performing a save as.

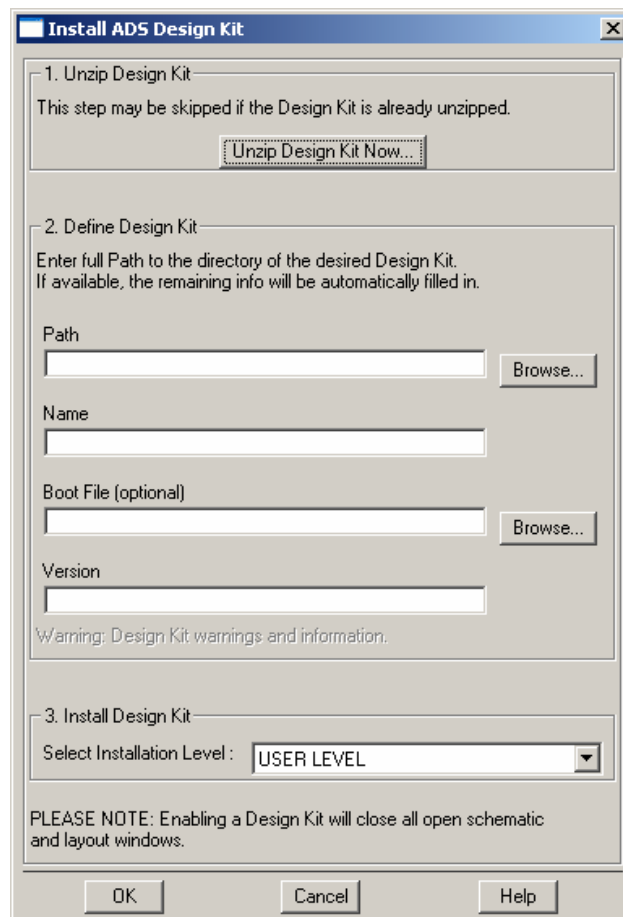
Next, follow the steps below to install the library and verify your successful installation. If you are having problems with the installation, you can view the [Design Kit Installation and Setup](#) manual dated September 2002 for ADS v2002c in the ADS v2002c documentation (Specifically Page 2-5). If you are still unable to install the library successfully, please go to the Support section of this document for information on how to get support from us or Agilent.

The following steps assume you currently have ADS v2002c correctly installed and that you have root or administrative access to your ADS installation. If ADS_MOT_LIBRARY_v2002p0502 is currently installed and is enabled, please refer to Section IV. Removing Design Kits in ADS2002c before continuing to step B. Install Design Kit.

B. Install Design Kit

1. **Choose DesignKit > Install Design Kits from the ADS main window.**

The following dialog box will appear:



Install ADS Design Kit

1. Unzip Design Kit
This step may be skipped if the Design Kit is already unzipped.

2. Define Design Kit
Enter full Path to the directory of the desired Design Kit.
If available, the remaining info will be automatically filled in.

Path

Name

Boot File (optional)

Version

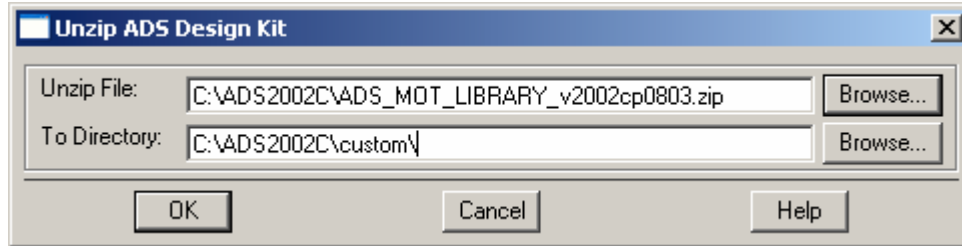
Warning: Design Kit warnings and information.

3. Install Design Kit
Select Installation Level :

PLEASE NOTE: Enabling a Design Kit will close all open schematic and layout windows.

2. Unzip the ADS Design Kit Zip file which you just downloaded.

Click the **Unzip Design Kit Now** button. The following Dialog box will appear:

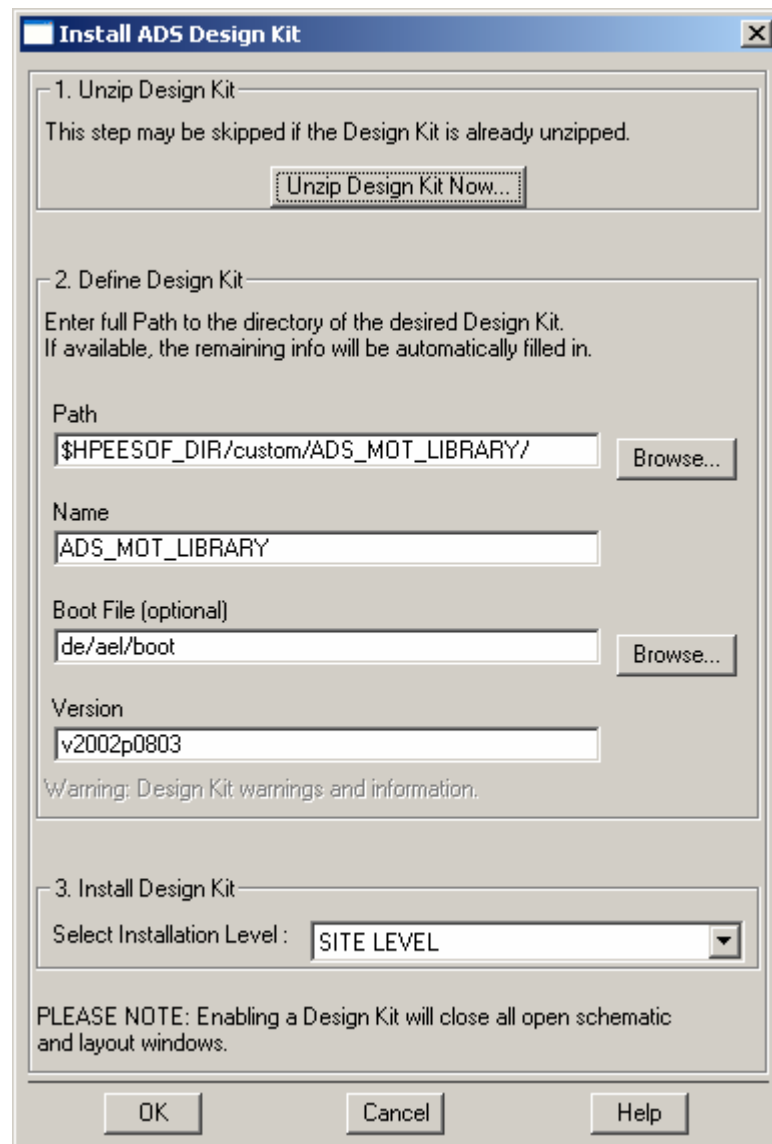


Enter the path to the zip file and enter the path for the **To Directory** field which is where you want to located the Design Kit. The Browse buttons will help you locate the zip file and To Directory locations. Above, I have selected the default ADS custom directory for a SITE wide installation. (This path is highly suggested, but optional.)

Click the **OK** button and a new directory called **ADS_MOT_LIBRARY** will appear within the directory path specified in the **To Directory** field that was specified. Within this new directory should be the following sub-directories: (1) circuit, (2) de, (3) design_kit, (4) doc, (5) examples and (6) bin.

3. It is now time to Define the Design Kit.

When the unzip procedure is complete, the Install ADS Design Kit dialog box will reappear with default values specified for Path, Name, Boot File, and Version. This is shown below:

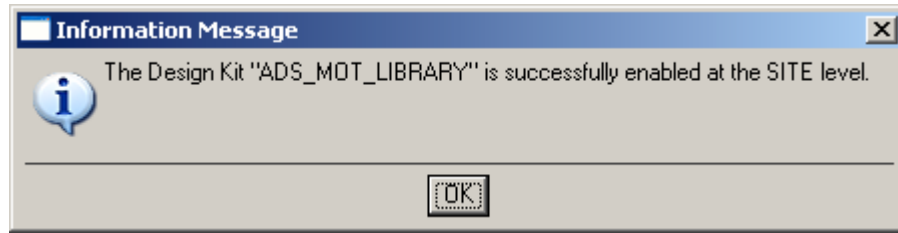


It is not necessary for you to manipulate any of the default values unless you want to perform some extra customization. However, this extra customization is not recommended.

4. Finally install the design kit.

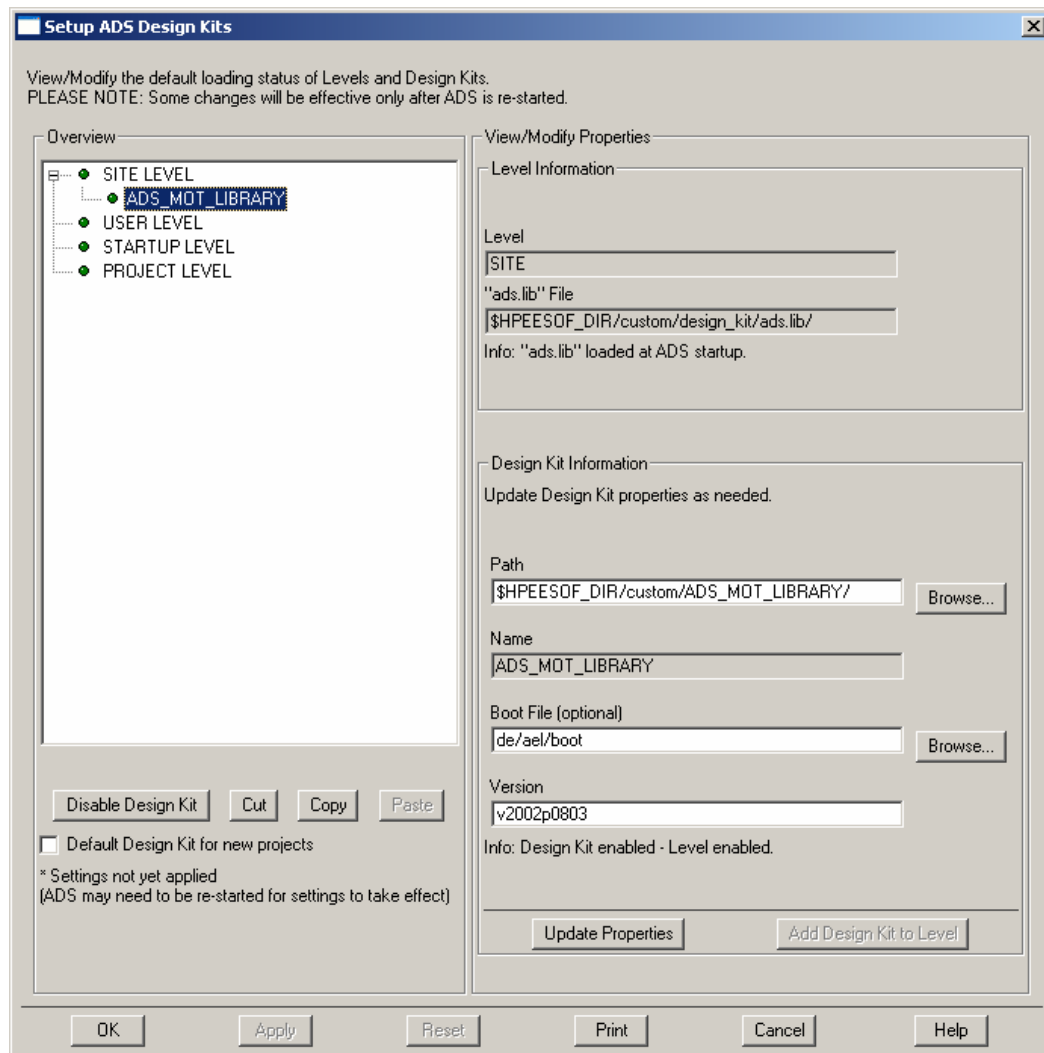
You will need to make a choice within the **Select Installation Level** field. Above, the Site Level or Site-Wide installation was selected because the Design Kit was unzipped and installed in the ADS custom directory. You as the user can select "SITE LEVEL", "USER LEVEL", "STARTUP LEVEL" or "PROJECT LEVEL". Please view the documentation in the installation manual on page 2-14 and decide for yourself how the DK will be used. It is suggested that it be placed as a SITE LEVEL installation. After the selection is made, press the **OK** button.

If the installation was successful, the following dialog box will appear:



C. Verify your Design Kit Installation

To verify your Design Kit Installation choose **DesignKit > Setup Design Kits** from the main window. The following dialog box will appear:

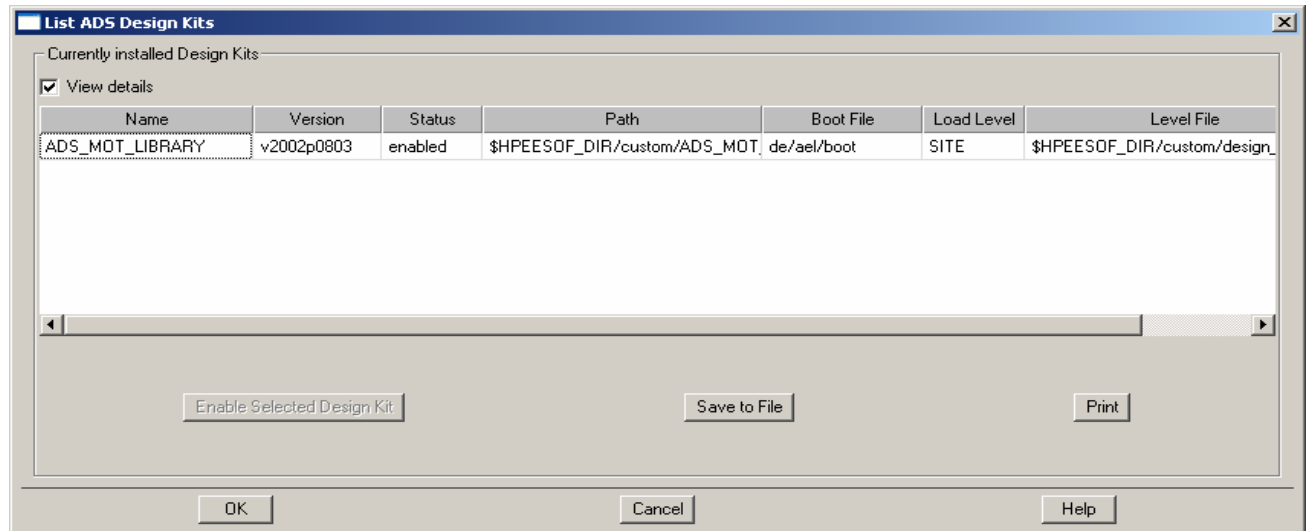


Click on the **ADS_MOT_LIBRARY** DK from under the level at which it was installed such as the above to verify the installation paths, names, version, etc.

Warning: If the **SITE LEVEL** is disabled (Yellow button beside **SITE LEVEL**), click on **SITE LEVEL** and choose **Enable Level**. Typically the **SITE LEVEL** is disabled and if you installed the DK at the **SITE LEVEL**, you must enable the **SITE LEVEL** and click the **OK** button to enable design kits within this level.

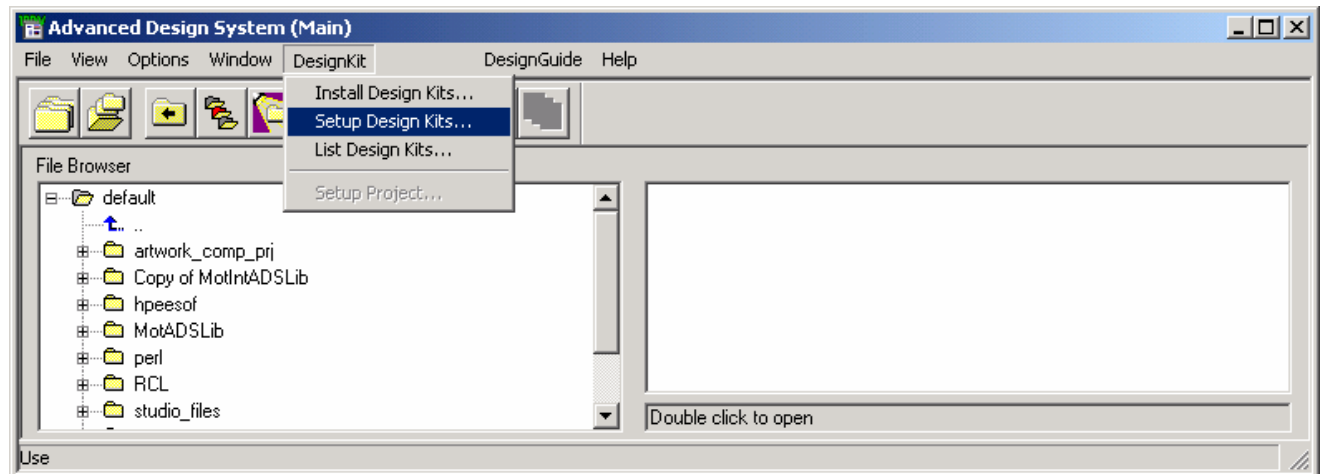
D. Listing Design Kits in use and enabled at each level.

Choose **DesignKit > List Design Kits ...** to view these design kits and the following dialog box appears:

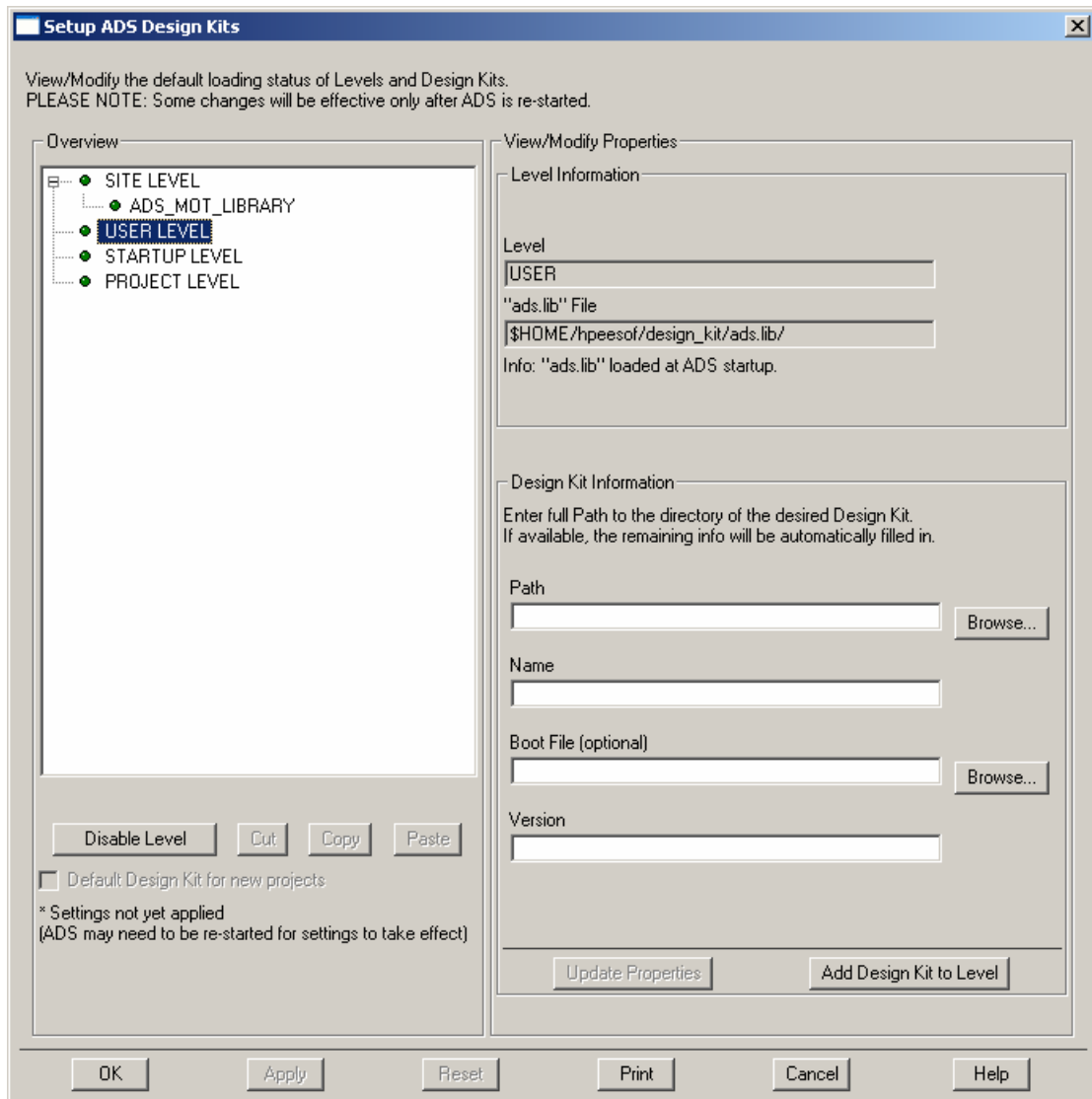


IV. Removing Design Kits in ADS v2002c

Agilent has not provided a path for users who have installed Design Kits to also remove them when the need occurs. So, the removal of the design kits is a manual process. However, a user can disable a Design Kit by selecting the Setup Design Kits... Menu choice from the Design Kit menu in the main ADS window.

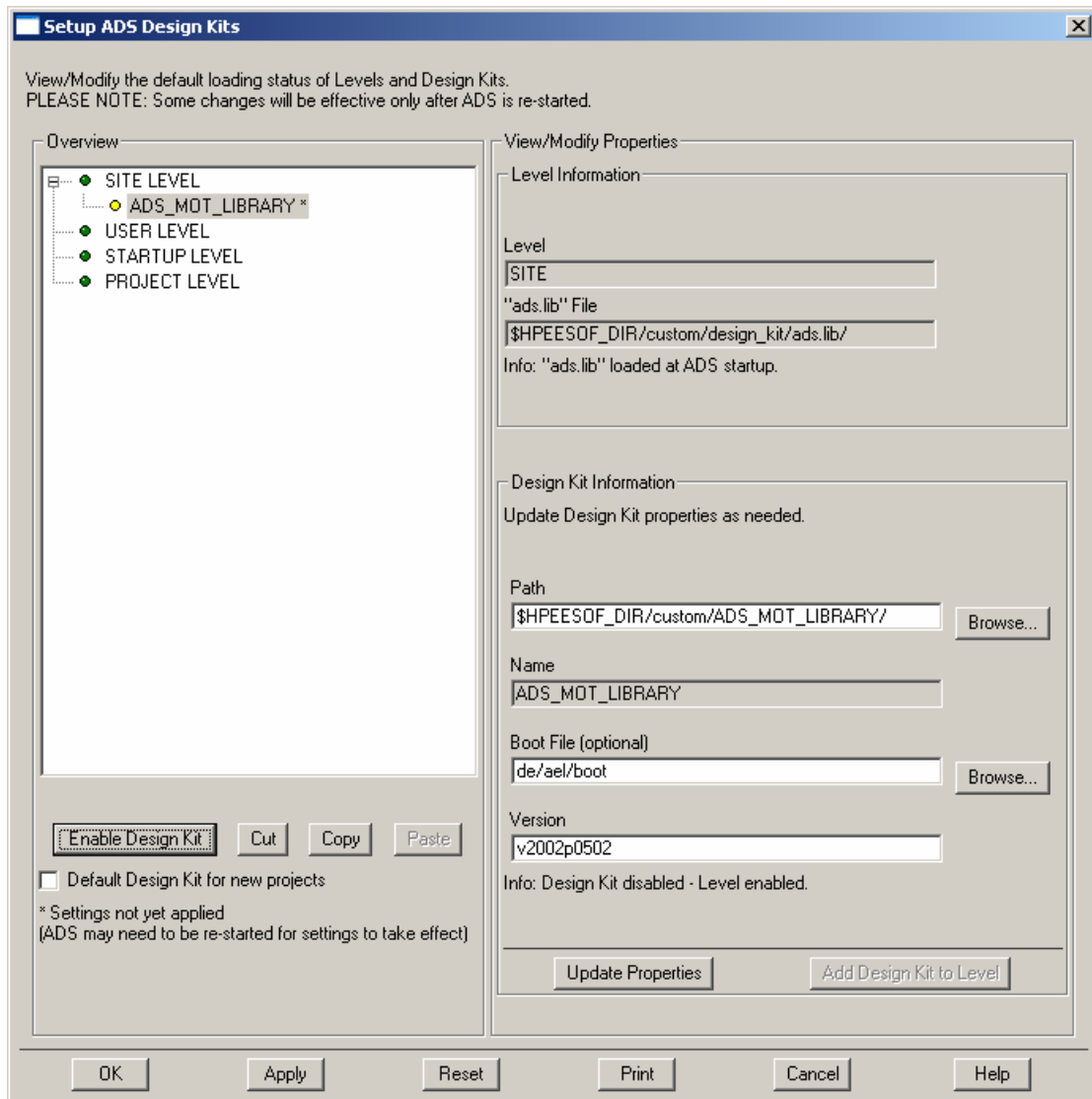


When the following Setup Design Kits Dialog Box appears as below,



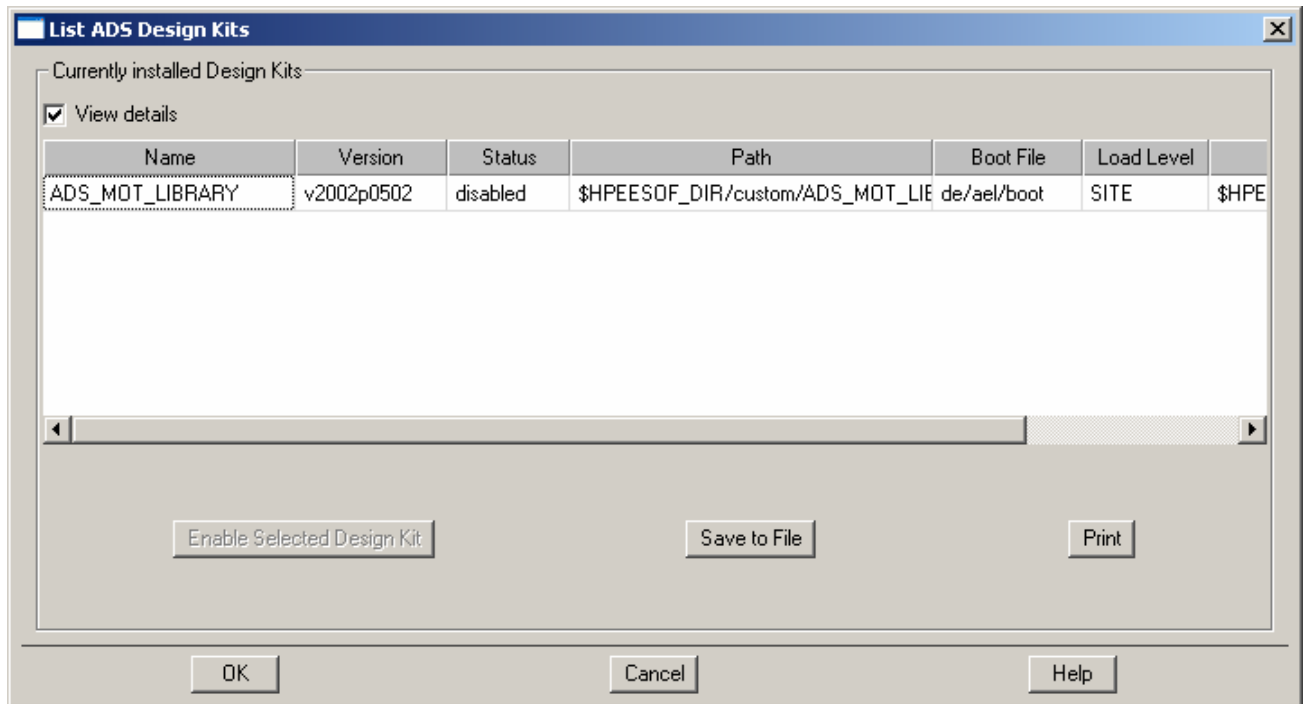
select the Design Kit to Disable and click the Disable Design Kit Button.

Then the Design Kit will appear in the Dialog Box like the ADS_MOT_LIBRARY in the picture below:



Note: You must then select Apply or OK and then restart ADS for the changes to take affect.

You can then verify the disabled DK, by selecting the List Design Kits... Menu choice from the Design Kit Menu in the Main Window to get something similar to the image below:

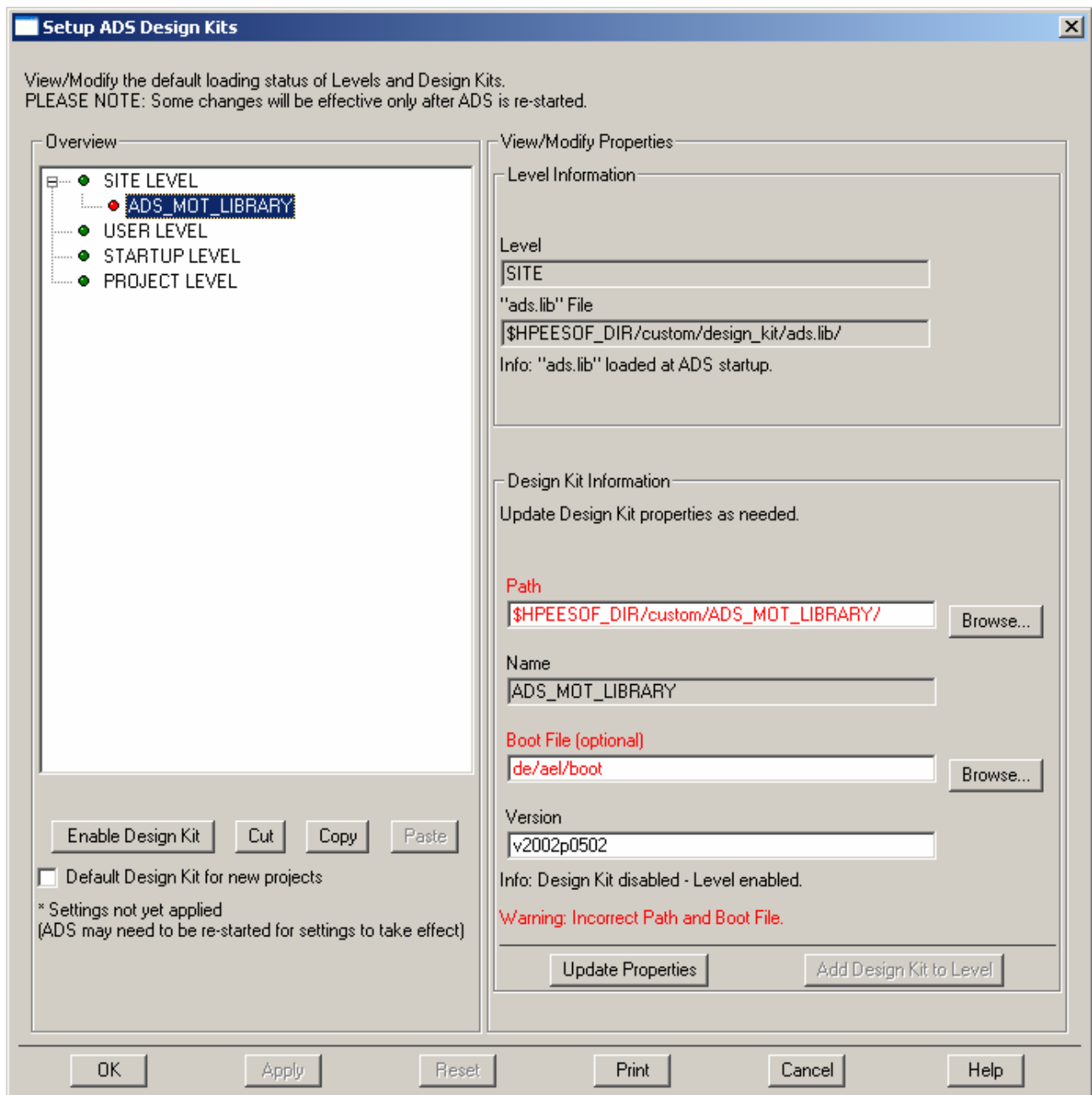


The directory for the Design Kit still exists even though it is disabled. ADS v2002c *will not* let the user unzip a new Design Kit over the old one with the same name when going through the install procedure. ***The user must manually delete the directory tree of the DesignKit before installation can begin on an update.*** For example, the owner of the ADS v2002c installation directory would have to go to the ADS custom directory and delete the disabled DK directory tree DesignKitName/ in a command window or file manager program.

After deleting the DK directory tree and restarting ADS, the Setup DesignKits Dialog box will appear with a ***red bullet*** and ***red text*** because the path no longer exists as below:

The user can then select the DesignKit and push the Cut Button to remove the kit completely and then press OK to activate the changes. After restarting ADS v2002c again, the disabled/deleted DK will no longer appear in the List of Design Kits window.

This is a tedious procedure which will most likely be changed in future releases of ADS.



V. Customer Project Read-me

This Readme First document outlines how to install the latest Customer Example Motorola LDMOS project directory for ADS v2002c and how to use the examples within successfully.

A. ADS v2002c Users: Installing the customer_ads_v2002p0502_prj directory

The first step is to download the customer_ads_v2002p0502_prj file with the web browser by right clicking with the mouse on the hyperlink and performing a save as to the directory in which you want to “unzip” the directory.

1. ADS v2002c Unix Users

Download file *customer_ads_v2002p0502_prj*

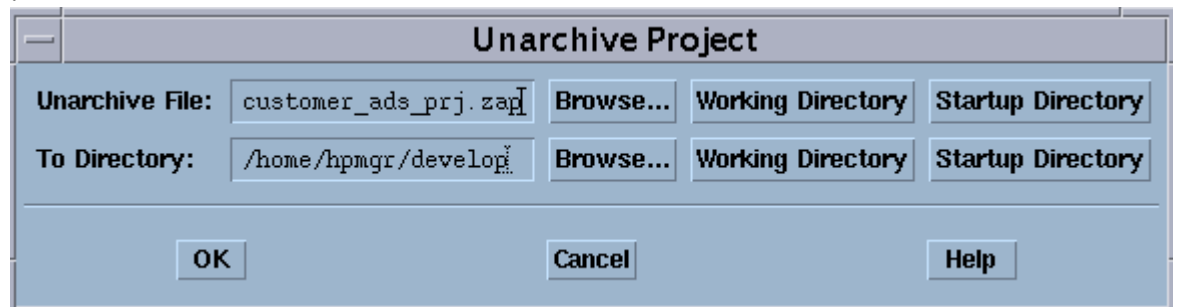
a) Unzip the downloaded file by using ADS's unzip utility found in the bin directory of the ADS installation directory. For example, from a UNIX csh shell command prompt:

```
setenv HPEESOF_DIR /rf/apps/ads/2002c
$HPEESOF_DIR/bin/unzip customer_ads_v2002p0502_prj.zip
Archive: customer_ads_v2002p0502_prj.zip
  inflating: customer_ads_v2002p0502_prj.zap
```

Resultant file is an ADS zap archive file called:

customer_ads_v2002p0502_prj.zap

b) Open ADS as normal and from the File menu select “Unarchive Project...” to unzip the directory.



c) **The resultant project directory will be called: customer_ads_v2002p0502_prj.**

The directory is just like any other ADS project Directory and is ready to use. Choose Open Project from the File directory to open this project.

2. ADS v2002c PC Users

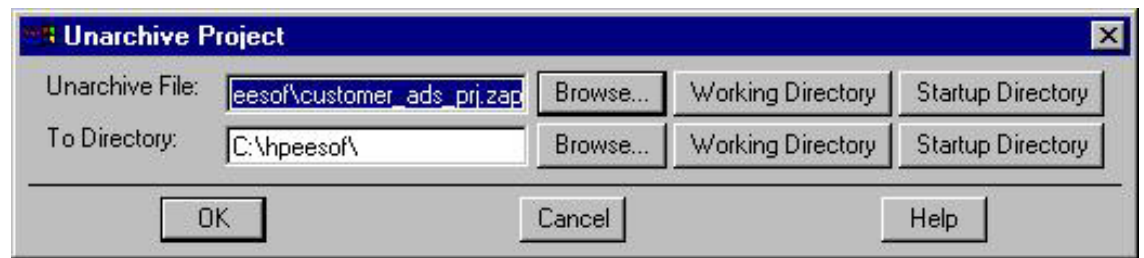
Download file *customer_ads_v2002p0502_prj.zip*

a) **Unzip the downloaded file by using ADS’s unzip utility found in the bin directory of the ADS installation directory. For example, from a DOS prompt:**

```
set HPEESOF_DIR=C:\ ads2002c
%HPEESOF_DIR%\bin\unzip customer_ads_v2002p0502_prj.zip
Archive: customer_ads_v2002p0502_prj.zip
  inflating: customer_ads_v2002p0502_prj.zap
```

Resultant file is an ADS zap archive file called *customer_ads_v2002p0502_prj.zap*

b) **Open ADS v2002c as normal and from the File menu select “Unarchive Project...” to unzip the directory.**



c) **The resultant project directory will be called: customer_ads_v2002p0502_prj.**

The directory is just like any other ADS project Directory and is ready to use. Choose Open Project from the File directory to open this project.

B. Utilizing the customer_ads_v2002p0502_prj successfully.

The instructions below assume that you are using ADS v2002c for UNIX or PC and currently have the customer_ads_v2002p0502_prj project already open. A schematic file called Base_Model.dsn is used as the DUT, device under test, within all of the example test schematics (*at the lowest subcircuit level, See Figure 1*) except for the Main_Transient, Main_1HB_Loadpull and Main_2HB_Loadpull designs. Therefore, it is easy to replace the current product model by editing the FET element and selecting a new model from the list. Or replace the MET LDMOS model with a Root LDMOS model from the Motorola LDMOS Models Palette and select the appropriate model from the list given.

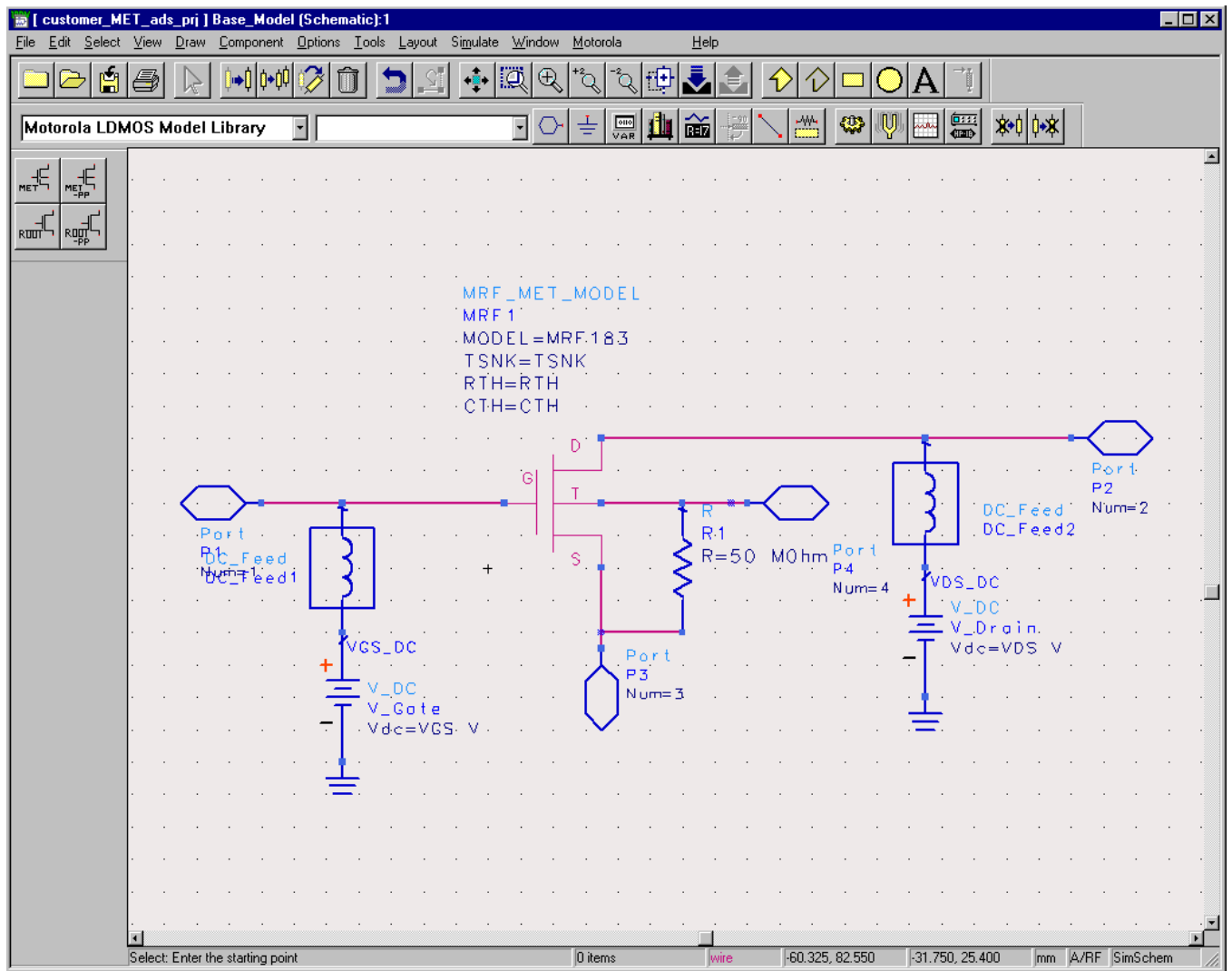


Figure 1: Schematic of Base_Model.dsn

Notice that Base_Model has as its parameters TSNK, RTH, CTH, VDS, and VGS. Therefore, any test circuit which uses Base_Model as its DUT is able to pass thermal parameters to the MET LDMOS model as well as Bias information.

Note: Keep these parameters in mind when replacing the given MET LDMOS model with another MET or Root LDMOS model. Also, setting TSNK, RTH, and CTH to a value of -1, tells the simulator to use the default value of the model.

1. Selecting a new MET LDMOS product model

A Library and Palette Group called “Motorola LDMOS Model Library” has been created with all of the current product models. Select a model type by clicking “Component Library” icon button and then click on the “Motorola LDMOS Model Library”.

There are four model types:

- 1) MRF_MET_MODEL, which is the MET LDMOS model,
- 2) MRF_MET_PP_MODEL, which is the MET LDMOS Push-Pull Model,
- 3) MRF_ROOT_MODEL, which is the Root LDMOS model, and
- 4) MRF_ROOT_PP_MODEL, which is the Root LDMOS Push-Pull Model.

Figure 2., shows editing the current MRF_MET_MODEL and selecting a new product model to simulate inside the Base_Model design.

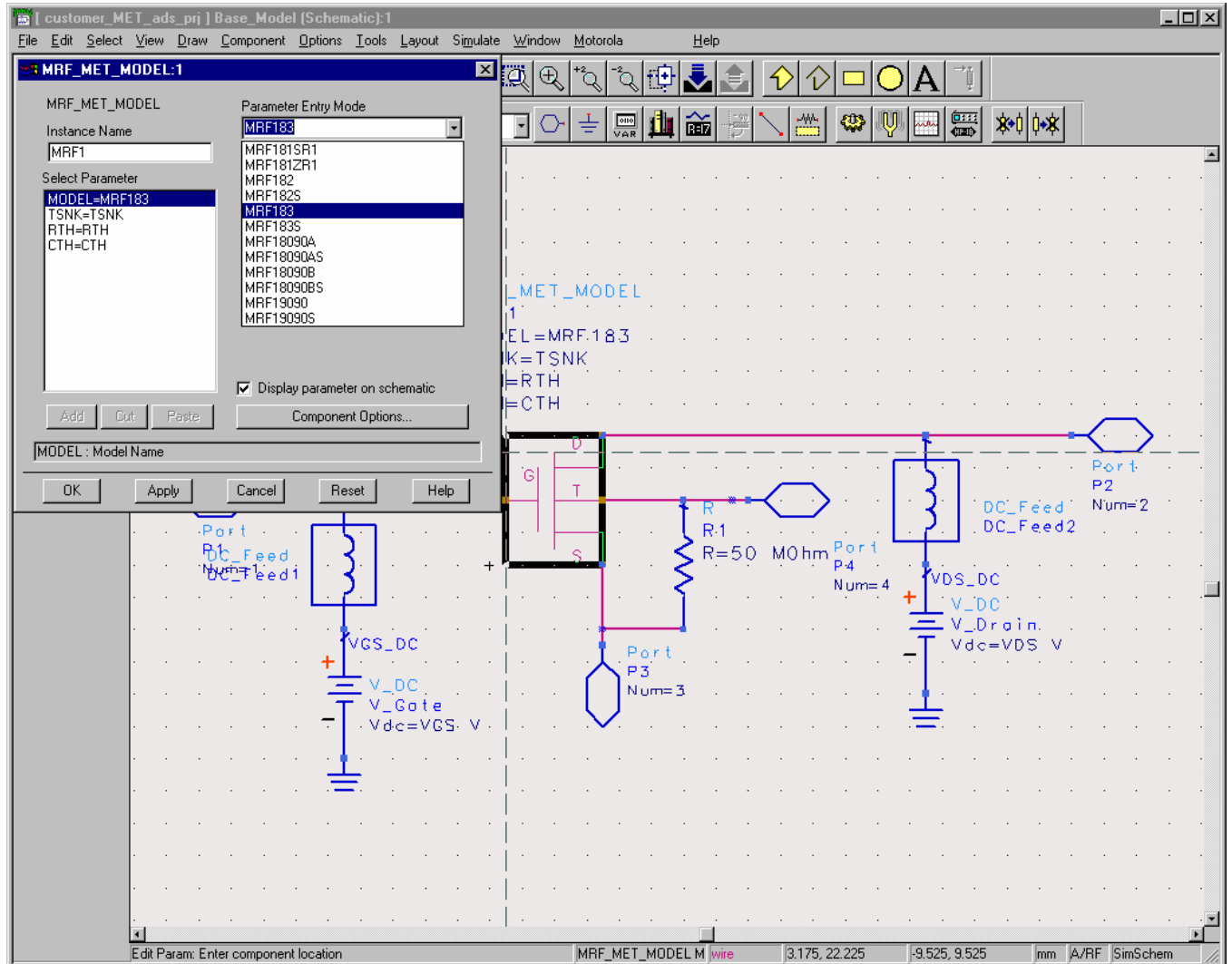


Figure 2: Selecting a new MET LDMOS Product Model

2. Selecting a Root Product Model.

The procedure above can be duplicated to also select a Root LDMOS model from the palette or library group and replace the present MRF_MET_MODEL element. Since the Root model has no temperature component, the Fourth Node of Base_Model remains unconnected. This, however, is not a problem when simulating. Also, the parameters of Base_Model, TSNK, RTH, and CTH do not affect the circuit when the Root LDMOS model is used.

Figure 3., shows replacing the MRF_MET_MODEL with a new MRF_ROOT_MODEL and editing and selecting a new product model from the list given.

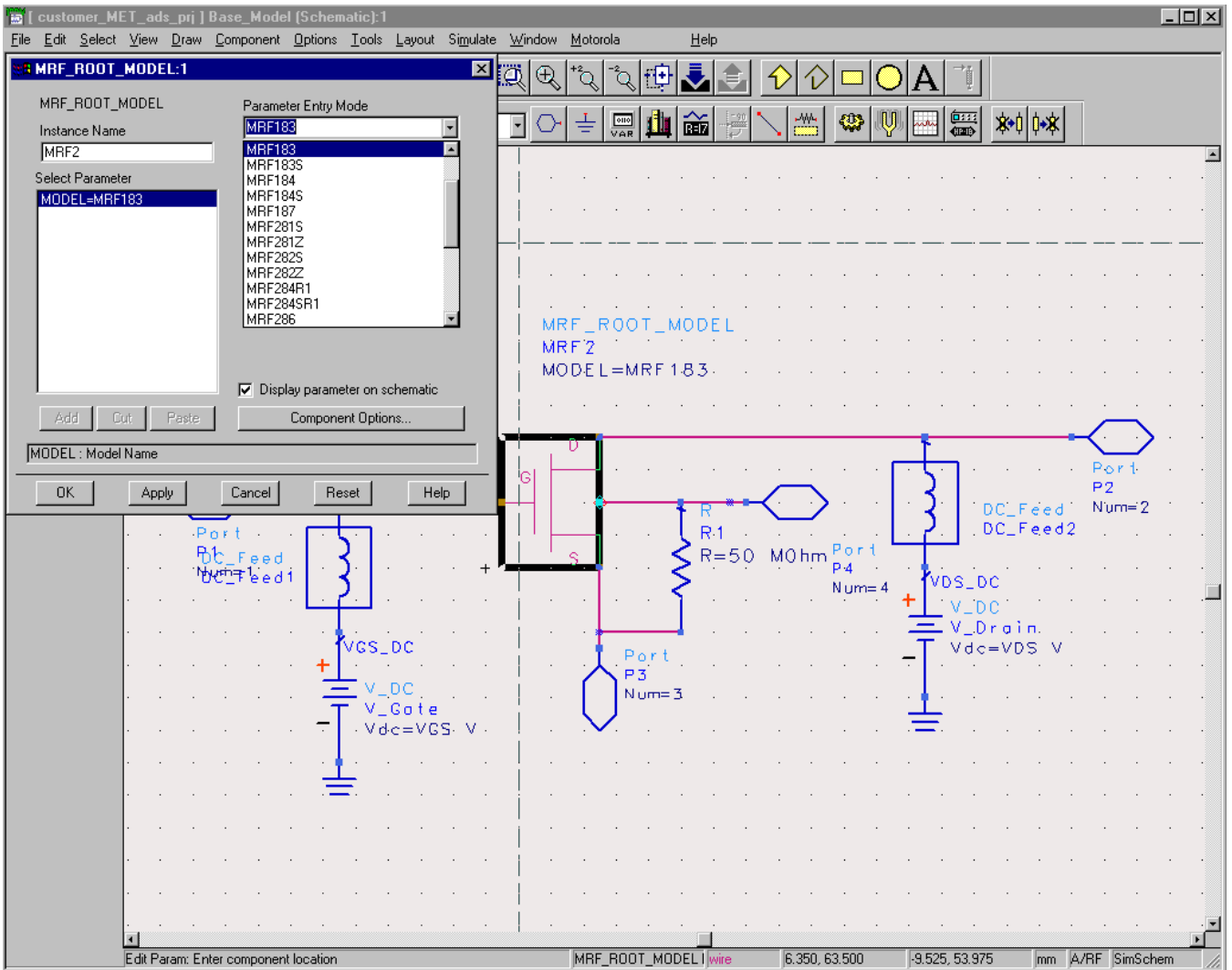


Figure 3: Selecting and Editing Choice of the MRF_ROOT_MODEL

3. Simulating product models correctly

As stated previously, the Base_Model.dsn schematic is the DUT for all of the example test schematic designs except for the Main_Transient, Main_1HB_Loadpull and Main_2HB_Loadpull designs. By following the above procedure for selecting the desired product model, each example test circuit is ready to simulate. Before simulation, however, be sure to adjust the frequency, bias, and power stimulus controls for your desired test setup. The VAR block in each test bench may also contain some variables that affect the test setup and may also need to be modified.

Please note that the new MOT_TECH_INCLUDE element has been placed at all top-level simulation schematics which is now a requirement of the new Design Kit structure.

VI. Troubleshooting ADS Installation Problems

Please verify that the LDMOS Model Design Kit Library was installed correctly by going through the installation procedures outlined in this document before trying to troubleshoot problems.

Below is a table of common problems and answers to questions that may help you complete your installation if you are having problems.

| Problem | Possible Solution: |
|--|--|
| <p>Under Unix, when starting ADS following the installation, the messages Loading Motorola's ADSv2002cp0803 LDMOS Model Library ... Motorola's ADSv2002cp0803 LDMOS Model Library Load Complete! do not appear upon startup.</p> <p>Under PC or Unix, after ADS is open, the Motorola LDMOS Model Library does not appear in the schematic palette or within the Component Library Browser window.</p> <p>Under PC or Unix, the Motorola LDMOS Model Library palette exists within the schematic window; however, when picking and placing an element, I get several message windows saying that component symbol not found.</p> | <p>Check that the ADS_MOT_LIBRARY directory and all of its subdirectories are present in the ADS custom directory. Verify that you are running ADS v2002c. Verify that the design_kit directory exists within the custom directory and that the ads.lib file exists and is similar to the file shown in below.</p> |
| <p>Under PC or Unix, the Motorola LDMOS Model Library palette exists within the schematic window and I can pick and place model parts to the schematic; however, when I try to simulate, I get the following simulation error messages within the simulator window: Warning detected by HPEESOFSIM during netlist parsing. Error detected by HPEESOFSIM during netlist parsing ðMRF1í is an instance of an undefined model öí</p> <p>Under PC or Unix, the Motorola LDMOS Model Library palette exists within the schematic window and I can pick and place model parts to the schematic; however, when I try to simulate, a window pops up indicating OPEN_SIMULATOR ERROR</p> | <p>a.) Verify that the MOT_TECH_INCLUDE element exists in your top-level circuit which you are trying to simulate.</p> <p>b.) Check that the ADS_MOT_LIBRARY directory and all of its subdirectories are present in the ADS custom directory.</p> <p>c.) Verify that you are running ADS v2002c. Verify that the design_kit directory exists within the custom directory and that the ads.lib file exists and is similar to the file shown in below.</p> <p>d.) If ADS v2002c was installed after the Motorola LDMOS Model Library was installed the Motorola LDMOS Model Library needs to be re-installed once again.</p> |
| <p>Under PC or Unix I have done everything above and nothing seems to have an effect. The Motorola Library does not load at all or partially loads with errors.</p> | <p>Verify that all references to the <i>ADS_MOT_LIBRARY</i> environmental variable have being removed from your ADS startup wrapper script.</p> <p>All else fails, see Support section about starting a Customer Service Request or Contacting Agilent.</p> |

Example ads.lib file contained within the ADS v2002c custom/design_kit directory:
ADS_MOT_LIBRARY | \$HPEESOF_DIR/custom/ADS_MOT_LIBRARY | de/ael/boot.atf | v2002cp0803

VII. Known Problems

The following are known problems associated with the MET LDMOS model. This page will be updated regularly, as new problems are discovered and resolved. If you find a problem with the MET LDMOS do not hesitate to let us know. We will do our best to solve all problems or supply work arounds in a timely manner.

ADS v2002c:

1. The model might experience some convergence problems under two-tone conditions for some specific values of IF (f_2-f_1) impedance terminations. Problems have been experienced when the IF termination is close to an open (high impedance) condition.
2. Even though all the different simulation types have been coded in the senior modules (linear, nonlinear, AC, noise, and transient), the noise section of the code has not been tested.
3. Simulator convergence issues have been noticed by some customers using Harmonic Balance simulations (LSSP, HB1Tone, HB2Tone, etc.) with ideal 50 Ohm terminations on the input and output. Because of the low input and output impedances of some devices, it is suggested to use lower input and output impedance terminations, around 5 Ohms, to eliminate convergence problems.

VIII. Support

If you have difficulties installing or using the LDMOS Discrete Parts Design Kit, please feel free to contact us by selecting **LDMOS Model Help** from our main **Motorola RF LDMOS Model Web Page**. Go through the procedure to put in a customer service request and we will be glad to contact you and help you with your problems.

If you feel the problem is with your ADS v2002c installation, please contact Agilent EESof directly at 1-800-hpeesof.

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