Freescale Semiconductor

Agilent's Advanced Design System RF High Power Products Design Kit Release v2004ap0805

Release Notes and Installation Instructions

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I. INTRODUCTION

This current release of the RF High Power Products Design Kit for ADS v2004a has been implemented as follows:

- The Library is implemented as an Agilent® EEsof® EDA Advanced Design System (ADS) Design Kit and should be installed according to Agilent's instructions on installing Design Kits.

- There is now only one Zip file for all of the major platforms that Freescale Semiconductor supports (Microsoft® Windows® 2000, XP, Solaris® 8/9, HP-UX® 11.0/11.11i) and Red Hat® Linux® 7.2/7.3/8.0. This is because ADS v2004a now allows 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 for each computing platform.

- The Design Kit was implemented per Agilent's instructions contained in the *Design Kit Development Manual* (dated September 2004). Therefore, the structure of our library has been modified per Agilent's requirements so that Agilent can help support installation and simulation issues in the future. Because of this modification, we must now use a new element called *TechInclude* (see "Release Notes, TechInclude Element" in this document). The TechInclude element is now required on all top-level schematics for simulation purposes.

- The Library release includes the following:

  – MRFG35010—first GaAs part added to the library
  – Two new RF IC products
  – Six new plastic devices
  – MRF6P18190H in a lower thermal resistance package
  – MET Models for the MRF28* models
  – Updated MW4IC2230 model

The Freescale Semiconductor RF 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

Because of the change from a totally customized library to an ADS Design Kit, a TechInclude element is now required. For this and future releases, you must insert the FSL_TECH_INCLUDE element at the top-level of all designs where simulation is performed. ADS only allows you to place one TechInclude element on any one design. If you do not place the TechInclude element at the top-level or if you place it within a subcircuit, a simulation error will occur. For example:

```
Error detected by HPEESOFSIM during netlist parsing
   `MRF1` is an instance of an undefined element …
```

The FSL_TECH_INCLUDE element is now the sixth element in the Freescale Semiconductor RF High Power Model Library palette and looks like the following when placed in a schematic:

FSL_TECH_INCLUDE
FTI

For more examples of using the TechInclude element, download the Customer Example Project from the Freescale Semiconductor RF High Power Model Libary website at http://www.freescale.com/rf/models. Go to Agilent EESOF's ADS. Right-click on the Agilent ADS v2004a Example Project hyperlink to download the example project.

B. Parts Added to the (v2004ap0805) Library

The following table contains (1) a new GaAs part, (2) new LDMOS parts and (3) models for existing parts that have been added to the RF High Power Products Design Kit v2004ap0805 release.

New GaAs Part

MRFG35010		

LDMOS Parts

MRF5S21045N	MRF6S18100N	MRF6P18190H
MRF6S20010N	MRF6S18060N	MRF5P21240H
MRF6S19100N	MW6IC2240	
MRF6S19060N	MW6IC2015	

**New MET Models for Existing Parts**

MRF281S	MRF282S	MRF284
MRF281Z	MRF282Z	

Cancelled Parts

The following part has been labeled as cancelled in the design:

MET Models	Root Models
MRF5P21240	MRF5P21240

If any of these part names are referenced in existing designs and need to be used, you must replace FSL_MRF_MET_MODEL/FSL_MRF_ROOT_MODEL elements with FSL_MRF_MET_CANCELLED_MODEL/FSL_MRF_ROOT_CANCELLED_MODEL elements, along with the FSL_MRF_MET_PP_MODEL/FSL_MRF_ROOT_PP_MODEL elements with FSL_MRF_MET_PP_CANCELLED_MODEL/FSL_MRF_ROOT_PP_CANCELLED_MODEL. The "Cancelled" version of these parts can *only* be found in the Component Library Browser under the Library heading, Freescale RF High Power Model Library.
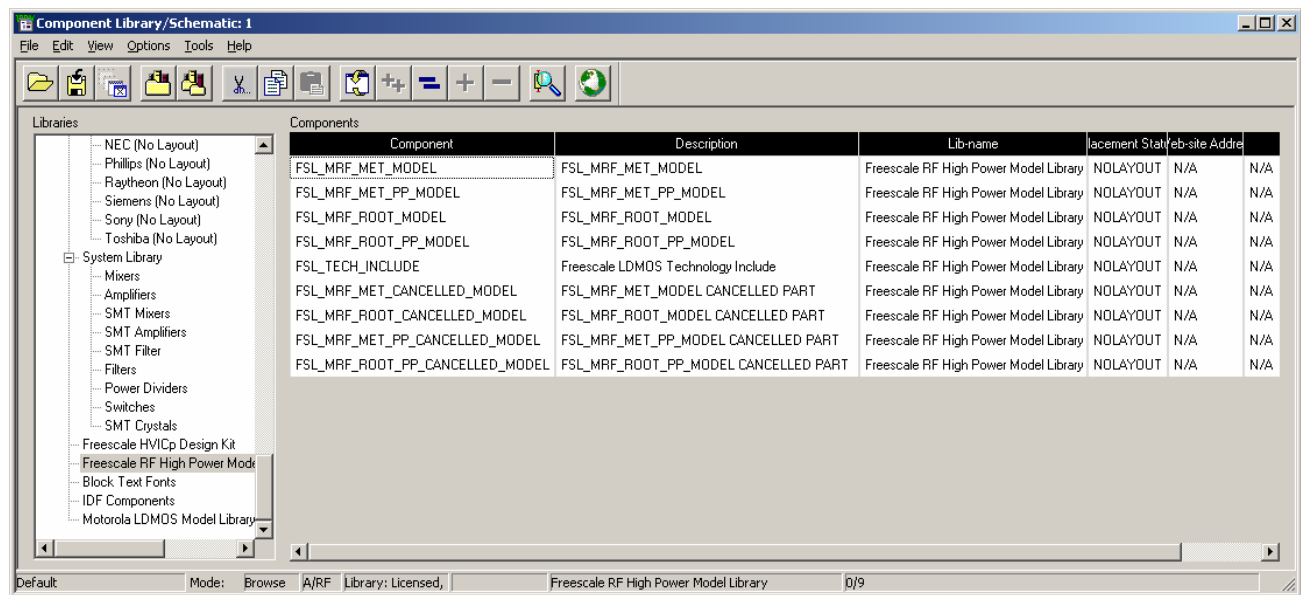
III. DESIGN KIT INSTALLATION *(v2004ap0805)*

A. Download Design Kit

This section outlines the procedures necessary to install the new RF High Power Products Design Kit (v2004ap0805) into ADS v2004a.

Before you can install the Design Kit, you must first go to the Freescale Semiconductor RF High Power Model website at http://freescale.com/rf/models. Click Agilent's ADS v2004a Library Release Notes and Installation Instructions, and download the ADS_FSL_LIBRARY_v2004ap0805.zip file by right-clicking on the file link and performing a Save Link/Target As to save the file to your desktop.

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 2004) for ADS v2004a in the ADS v2004a documentation (specifically, page 2-5). To install the Library successfully, go to the "Support" section of this document for information on how to get support from the Freescale Semiconductor RF Modeling Team or from Agilent.

The following steps assume you currently have ADS v2004a correctly installed and that you have root or administrative access to your ADS installation.
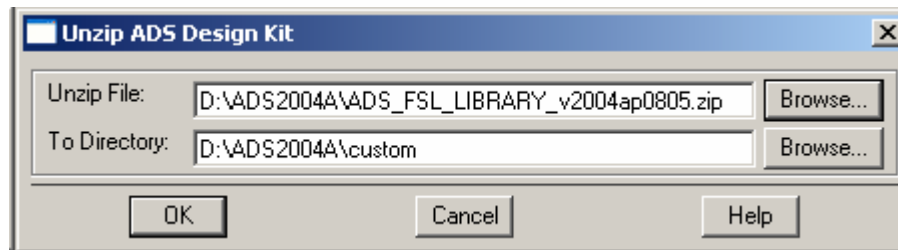
B. Install Design Kit

1. **Choose DesignKit > Install Design Kit from the ADS Main Window.**

   The following dialog box will appear:
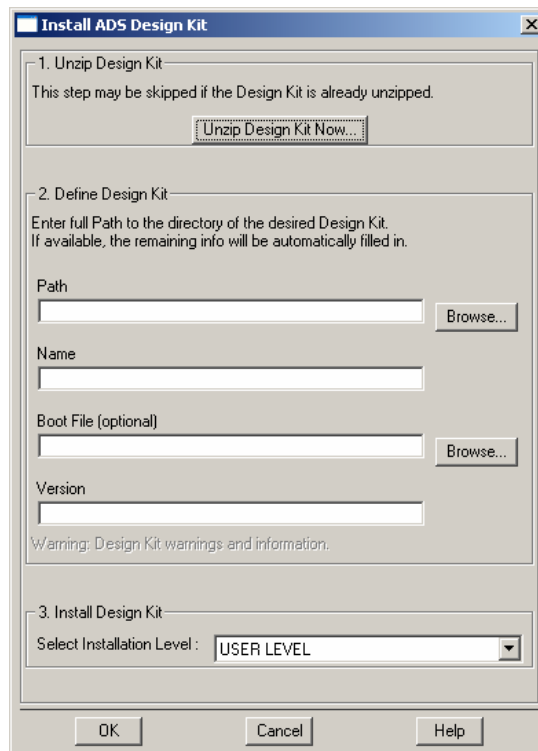
2. UnZip the Downloaded ADS Design Kit Zip File.

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

Enter the path to the Zip file. Enter the path for the **To Directory** field where you want the Design Kit to be located. Use the **Browse** buttons to help you locate the Zip file and To Directory locations. In the preceding example, the default ADS Custom directory was selected for a Site-Wide installation. (This path is highly suggested, but optional.)

Click **OK.** A new directory called ADS_FSL_LIBRARY will appear within the directory path that you specified in the **To Directory** field. Within this new directory, you should see the following subdirectories:

- circuit
- de
- design_kit
- doc
- examples
- bin

3. Define the Design Kit.

When the Unzip procedure is complete, the following Install ADS Design Kit dialog box will reappear with default values specified for Path, Name, Boot File and Version:
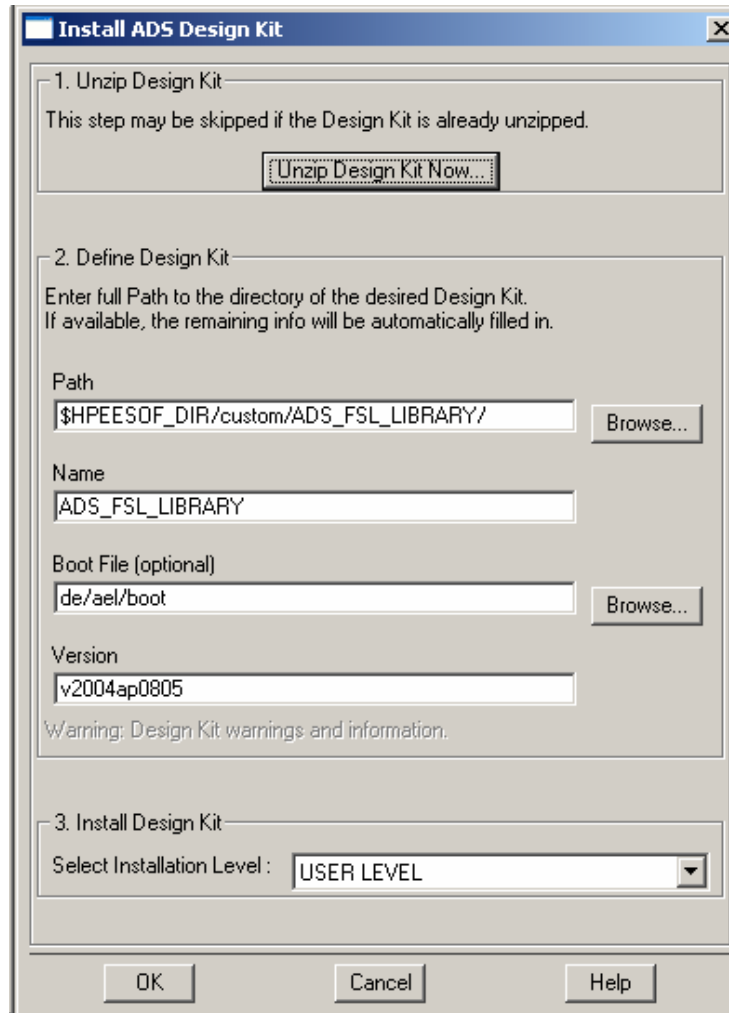
It is not necessary for you to manipulate any of the default values unless you want to perform some extra customization.

Note: Extra customization is not recommended.

4. Install the Design Kit.

You will need to make a choice within the **Select Installation Level** field. In the example above, the Site Level or Site-Wide installation was selected because the Design Kit was Unzipped and installed in the ADS Custom directory. You can select "SITE LEVEL," "USER LEVEL," "STARTUP LEVEL" or "PROJECT LEVEL." Review the *Design Kit Installation and Setup Manual* (page 2-14) and decide how the Design Kit will be used. We suggest that it be placed as a SITE LEVEL installation. After you make your selection, click **OK**.
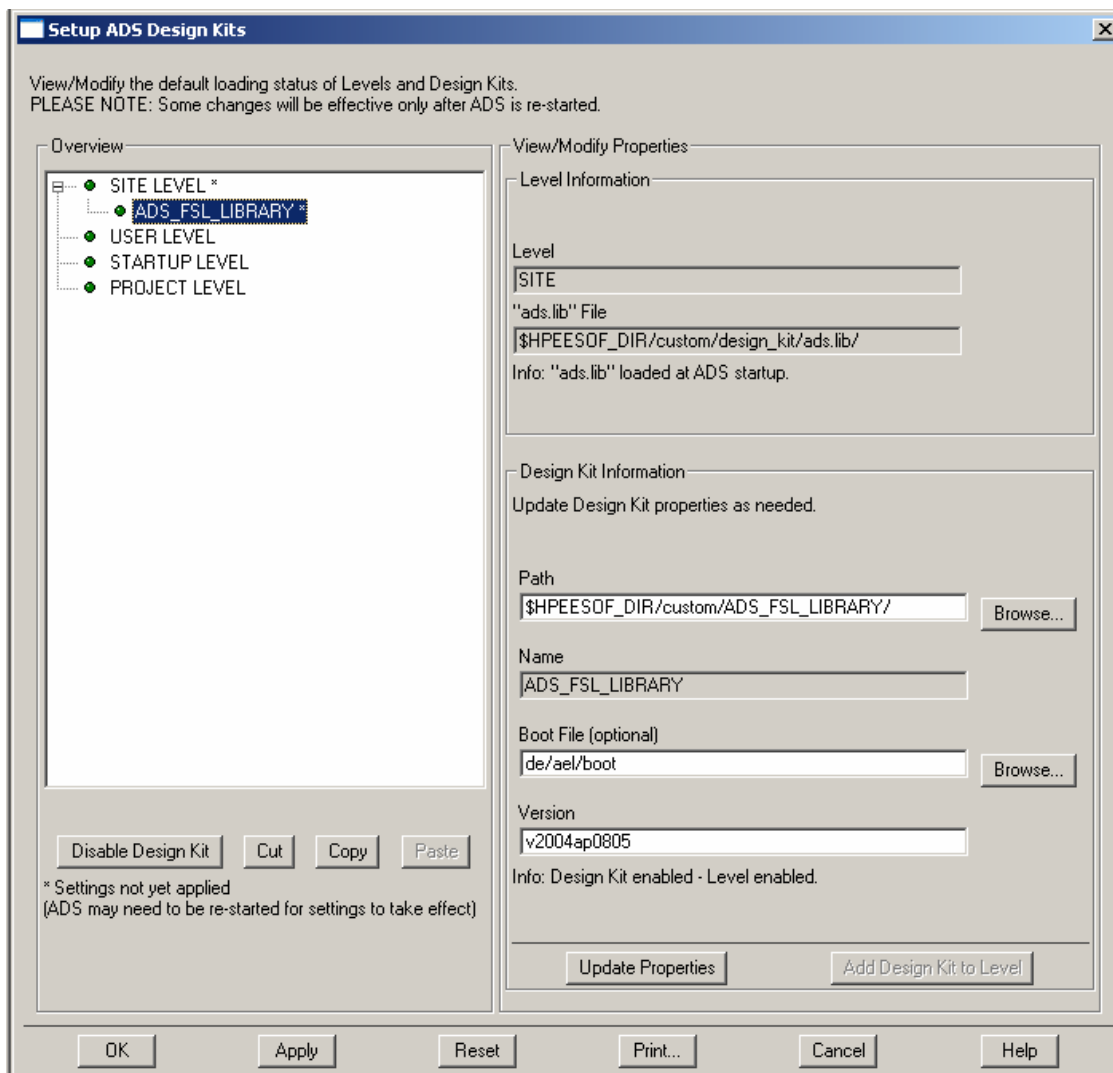
If the installation was successful, the following dialog box will appear:
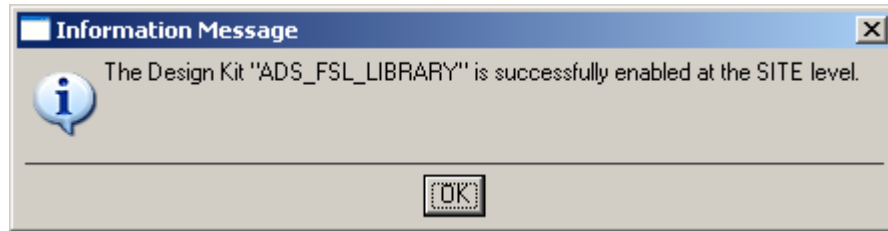
C. Verify Your Design Kit Installation

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


Click on **ADS_FSL_LIBRARY Design Kit** (it will be a subentry of the level where it was installed) to verify the installation paths, names, version, etc.

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WARNING: Typically, the SITE LEVEL is disabled (yellow button beside SITE LEVEL). If you installed the Design Kit at the SITE LEVEL, you must enable the SITE LEVEL by clicking **SITE LEVEL** and choosing **Enable Level**. Click **OK** to enable Design Kits within this level.

D. List Design Kits in Use and Enabled at Each Level

Choose **DesignKit > List Design Kits …** to view these Design Kits. The following dialog box appears:
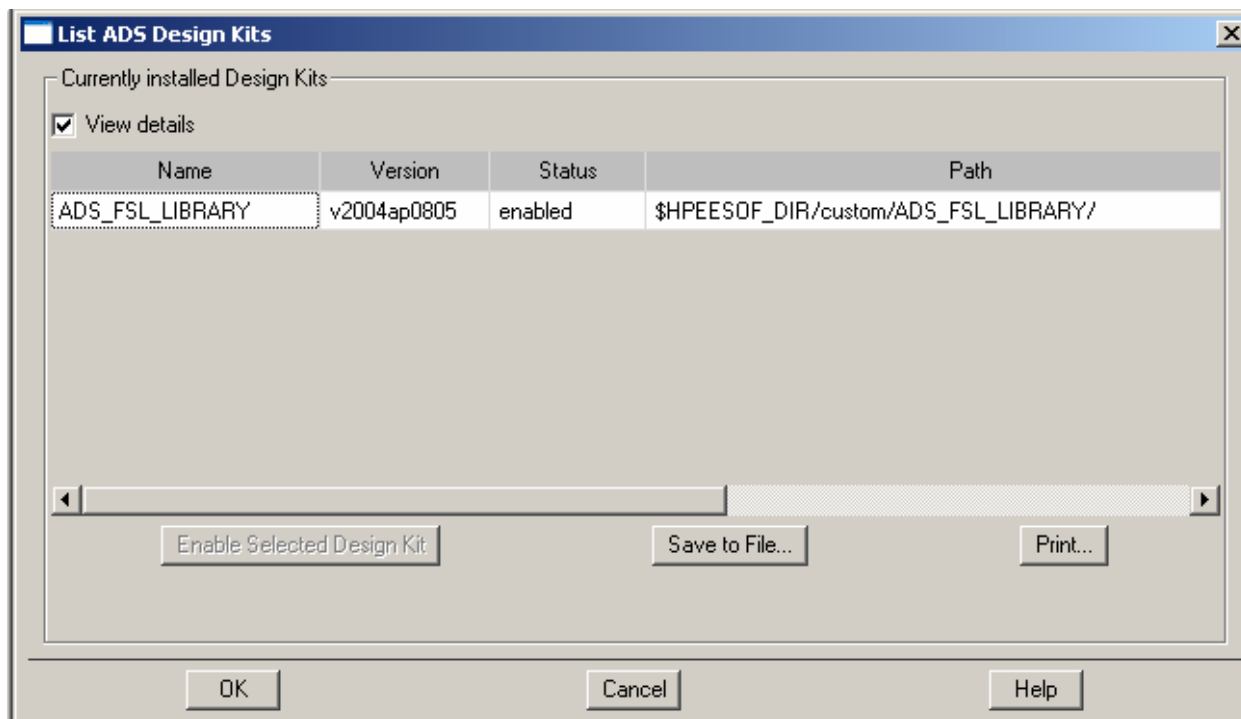
IV. REMOVING DESIGN KITS IN ADS V2004A

Agilent has provided a path for users to update existing Design Kits. When using the **Unzip Design Kit Now…** function button from the **Install ADS Design Kit** menu, the following dialog box will appear. Selecting **Yes** will overwrite the existing Design Kit with the updated version.
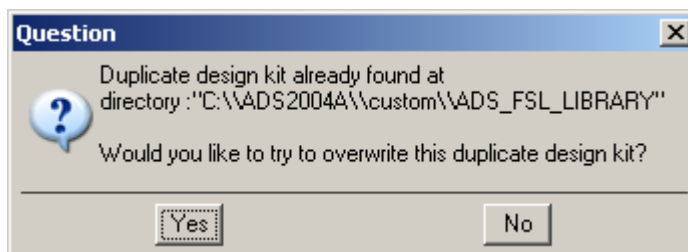
V. CUSTOMER PROJECT INSTALLATION

The custom project can be installed on all major platforms that support Microsoft Windows (Win32), Sun Microsystems (Solaris), Hewlett-Packard (HP-UX), and Red Hat Linux environments.

A. ADS v2004a Users: Installing the customer_ads_prj directory

Before you can install the Customer Example project directory, you must first go to the Freescale Semiconductor RF LDMOS website (http://freescale.com/rf/models). Go to Agilent EESOF's ADS. Right-click on the Agilent ADS v2004a Example Project hyperlink to download the customer_ads_v2004ap0105_prj.Zip file. Select Save Link/Target As to save the file to your desktop.
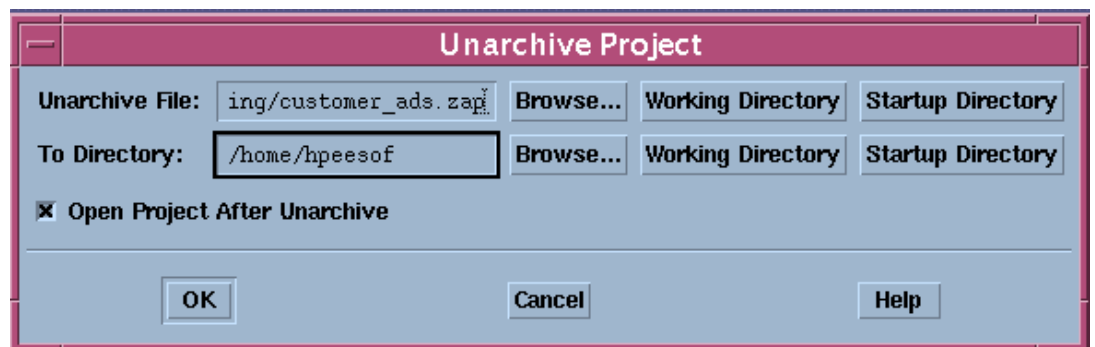
1. ADS v2004a Unix Users

a) Download the customer_ads_v2004ap0105_prj.zip file.

b) 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/2004a
$HPEESOF_DIR/bin/unzip customer_ads_v2004ap0105_prj.zip
        Archive:  customer_ads_ v2004ap0105_prj.zip
          inflating: customer_ads.zap
```

```
This creates a file in an ADS zap archive file called:
```

customer_ads.zap

c) Open ADS. From the File menu, select **Unarchive Project...** to unzap the directory.

d) The new project directory is called customer_ads_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 v2004a PC and Linux Users**

a) Download the customer_ads_v2004ap0105_prj.zip file.

b) 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:\ads2004a
%HPEESOF_DIR%\bin\unzip customer_ads_v2004ap0105_prj.zip
  Archive: customer_ads_v2004ap0105_prj.zip
   inflating: customer_ads.zap
```

The result is an ADS zap archive file called customer_ads.zap.

c) Open ADS v2004a. From the File menu, select **Unarchive Project…** to unzap the directory.
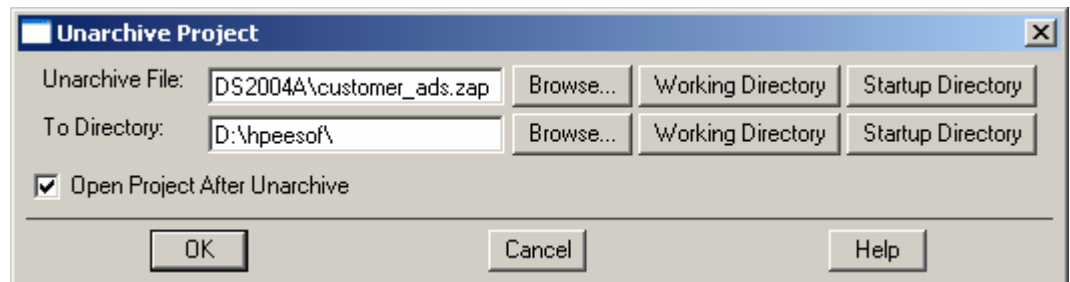
d) The new project directory is called customer_ads_prj.

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. Using the customer_ads_prj Project Directory

The following instructions assume that you are using ADS v2004a for Unix or PC and currently have the customer_ads_prj project already open. A schematic file called Base_Model.dsn is used as device under test (DUT), 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. You can also replace the MET LDMOS model with a Root LDMOS model from the Freescale RF High Power Model Library palette and select the appropriate model from the list given.
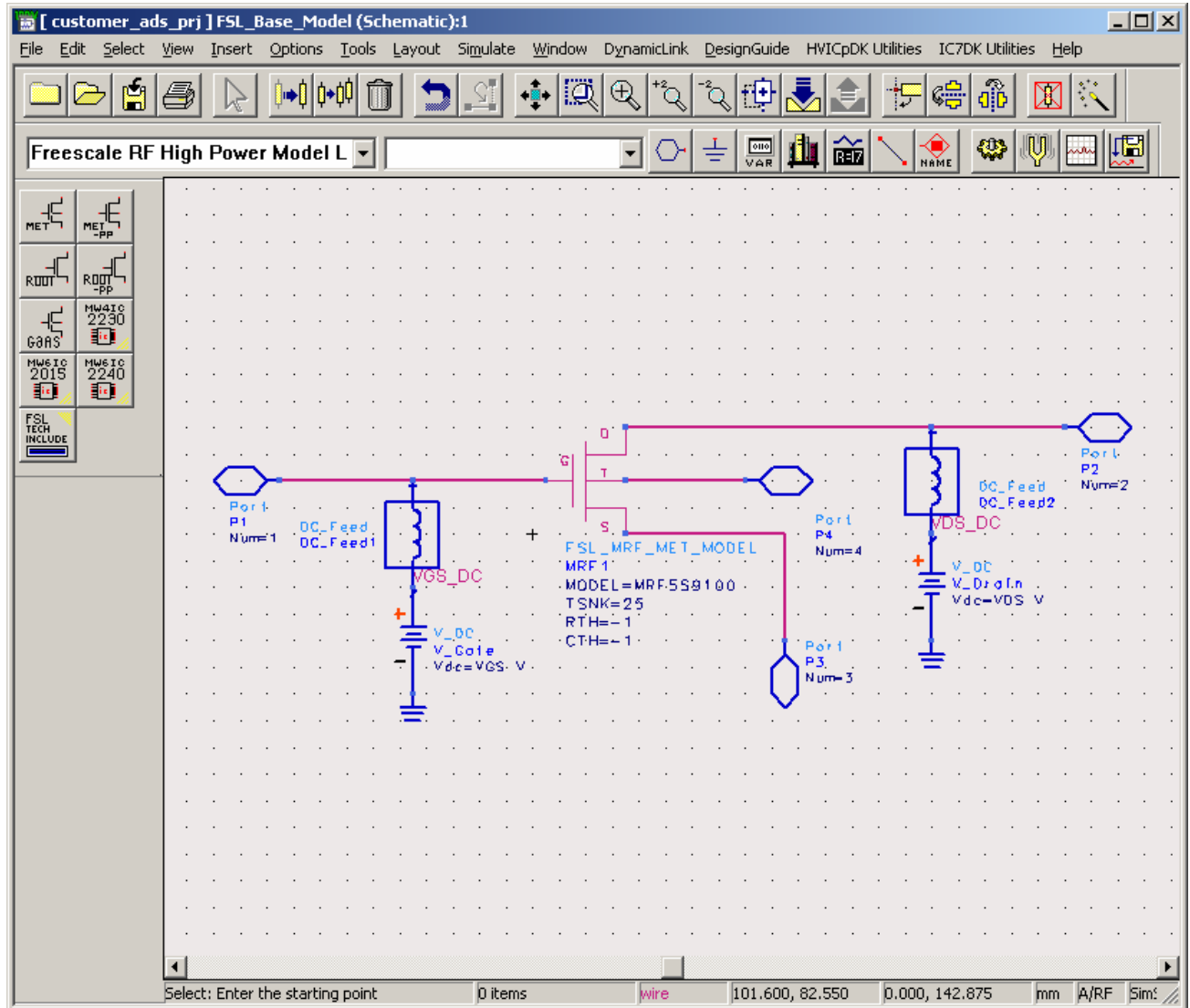
Figure 1. Schematic of FSL_Base_Model.dsn

Notice that Base_Model has as its parameters TSNK, RTH, CTH, VDS and VGS. Therefore, any test circuit that 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. 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—the Freescale RF High Power Model Library—has been created with all of the current product models. Select a model type by clicking the **Component Library** icon and then clicking **Freescale RF High Power Model Library**.

There are four model types:

- FSL_MRF_MET_MODEL—MET LDMOS Model
- FSL_MRF_MET_PP_MODEL—MET LDMOS Push-Pull Model
- FSL_MRF_ROOT_MODEL—Root LDMOS Model
- FSL_MRF_ROOT_PP_MODEL—Root LDMOS Push-Pull Model

Figure 2 illustrates how to edit the current FSL_MRF_MET_MODEL and select a new product model to simulate inside the Base_Model design.
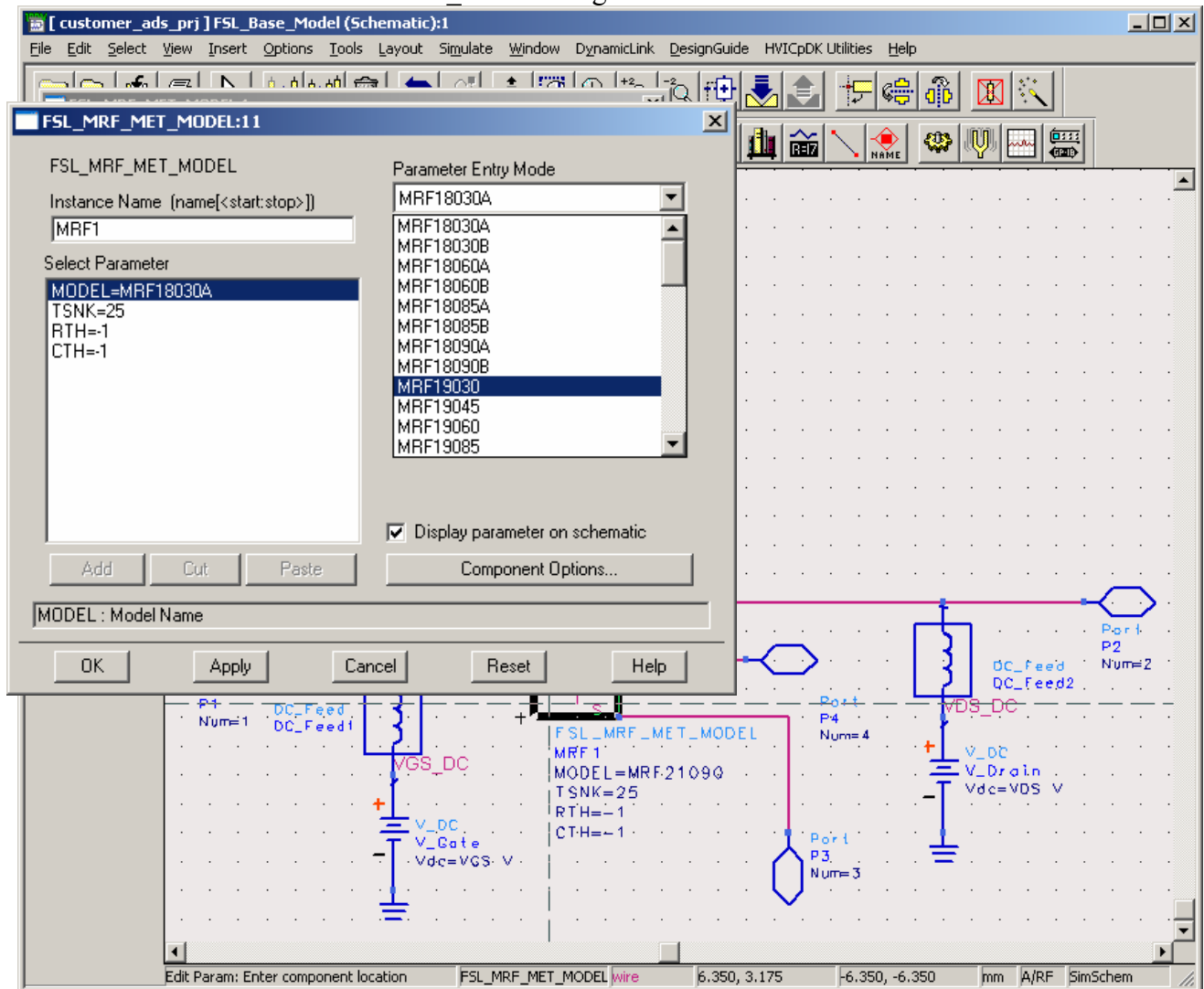

Figure 2. Selecting a New MET LDMOS Product Model

2. Selecting a Root Product Model.

The preceding procedure can also be used to select a Root LDMOS model from the palette or library group and replace the present FSL_MRF_MET_MODEL element. Because the Root model has no temperature component, the Fourth Node of Base_Model remains unconnected. However, this is not a problem when simulating. The parameters of Base_Model, TSNK, RTH and CTH do not affect the circuit when the Root LDMOS model is used.

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Figure 3 shows how to replace the FSL_MRF_MET_MODEL with a new FSL_MRF_ROOT_MODEL and how to edit and select a new product model from the list given.
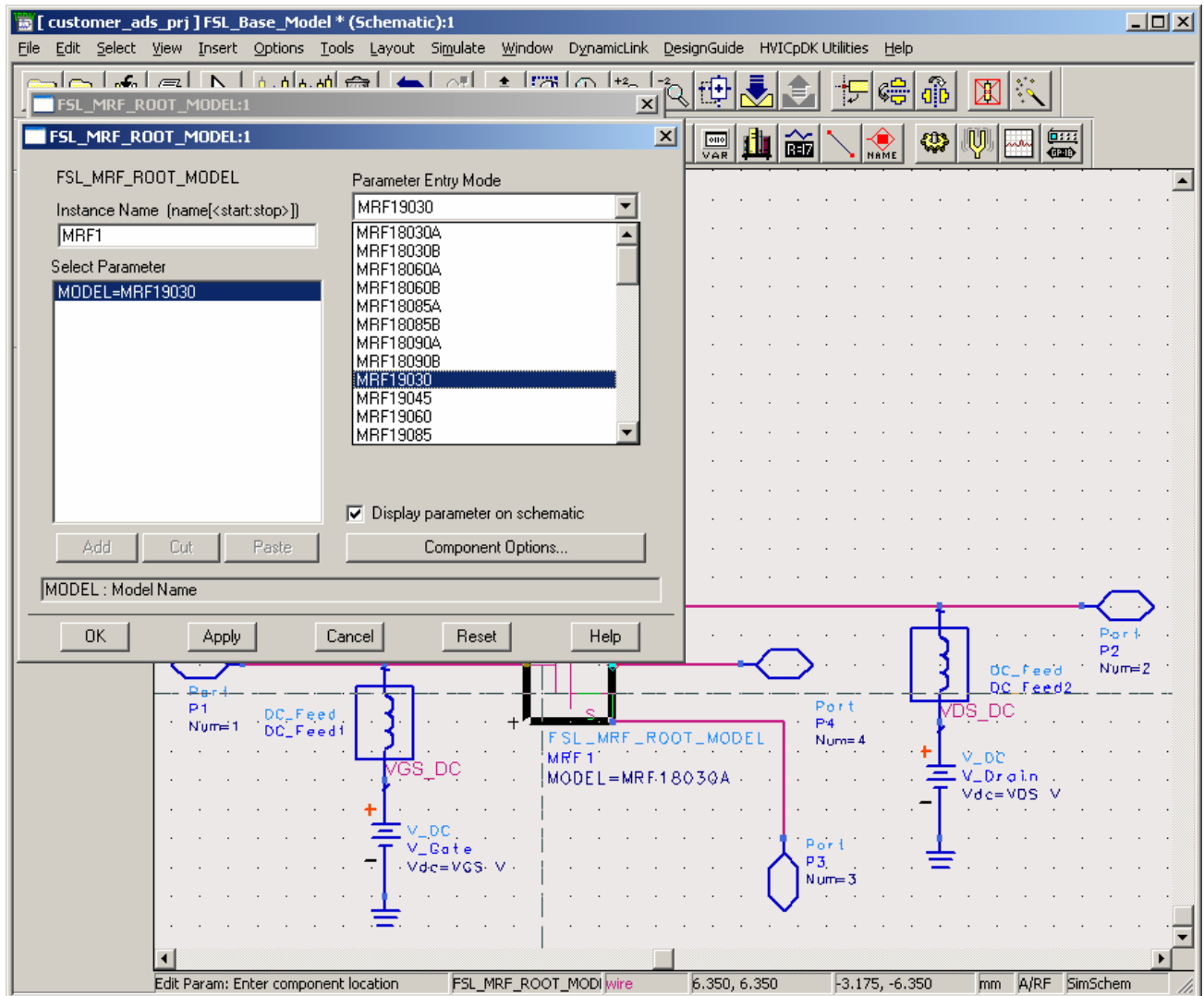
Figure 3. Selecting and Editing Choice of the FSL_MRF_ROOT_MODEL

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 preceding procedure for selecting the desired product model, each example test circuit is ready to simulate. Before performing a 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.

Note: The new FSL_TECH_INCLUDE element has to be 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.
Following is a table of common problems and solutions to help you complete your installation if you are having problems.

Problem	Possible Solution

Under Unix, when starting ADS following the installation, the messages
`Loading Freescale Semiconductor's ADSv2004ap0805 RF High Power Model Library`
`...`
`Freescale Semiconductor's ADSv2004ap0805 RF High Power Model Library Load Complete!`
do not appear upon startup.
 	
Under PC or Unix, after ADS is open, the Freescale RF High Power Model Library does not appear in the schematic palette or within the Component Library Browser window.
 	
Under PC or Unix, the Freescale RF High Power Model Library palette exists within the schematic window. However, when picking and placing an element, I get several message windows saying that the component symbol is not found.
	1. Check that the ADS_FSL_LIBRARY directory and all of its subdirectories are present in the ADS Custom directory.
	2. Verify that you are running ADS v2004a.
	3. 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 the footnote below.

Under PC or Unix, the Freescale RF High Power 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`
`ëMRF1í is an instance of an undefined model Ö'`
 	
Under PC or Unix, the Freescale RF High Power 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.
	1. Verify that the FSL_TECH_INCLUDE element exists in your top-level circuit that you are trying to simulate.
	2. Check that the ADS_FSL_LIBRARY directory and all of its subdirectories are present in the ADS Custom directory.
	3. Verify that you are running ADS v2004a.
	4. 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 the footnote below.
	5. If ADS 2004a was installed after the Freescale RF High Power Model Library was installed, the Freescale RF High Power Model Library must be re-installed.

Under PC or Unix, I have done everything above, and nothing seems to have an effect. The Freescale Semiconductor RF High Power Model Library does not load at all or partially loads with errors.	1. Verify that all references to the *ADS_FSL_LIBRARY* environmental variable have been removed from your ADS startup wrapper script. 2. If all else fails, see the "Support" section in this document about starting a Customer Service Request or contacting Agilent.

* Example ads.lib file contained within the ADS v2004a custom/design_kit directory:
ADS_FSL_LIBRARY | $HPEESOF_DIR/custom/ADS_FSL_LIBRARY | de/ael/boot.atf | v2004ap0805

VII.   KNOWN PROBLEMS

The following are known problems associated with the MET LDMOS model. This section 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 the Freescale Semiconductor RF Modeling Team know. We will do our best to solve all problems or supply workarounds in a timely manner.

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1. The model may experience some convergence problems under two-tone conditions for some specific values of IF (f2-f1) impedance terminations. Problems have been experienced when the IF termination is close to an open (high impedance) condition.
2. Even though all of 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 that lower input and output impedance terminations, around 5 ohms, be used to eliminate convergence problems.

VIII.   SUPPORT

If you have difficulties installing or using the RF High Power Products Design Kit, please feel free to contact the Freescale Semiconductor RF Modeling Team by selecting **RF LDMOS Model Help** from the Freescale Semiconductor RF High Power Models web page (http://freescale.com/rf/models). Follow the procedure for submitting a Customer Service Request. We will be glad to contact you and help you with your problems.

If you feel the problem is with your ADS v2004a installation, please contact Agilent EESof directly at 1-800-hpeesof (1-800-473-3763).

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