

# **Quick Start Guide**

## **Example DS125BR401 Agilent ADS Project**

Version 2  
April 2024

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## 1 Document Revision History

<b>Revision</b>	<b>Editor</b>	<b>Comment</b>	<b>Date</b>
1	Liang Liu	Initial creation of Quick Start Guide for example ADS project.	11-Nov-2012
2	Lucas Wolter	Updated for public release.	29-April-2024

## 2 Overview

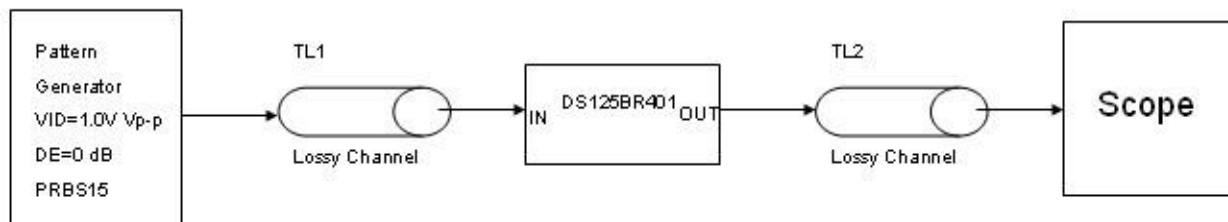
This document is a Quick Start Guide for a custom Agilent ADS project using the DS125BR401 Buffer Repeater in a generic channel topology. Table 1 below lists pertinent information related to the delivered project.

**Table 1: Quick Start Guide related information**

Item	Value/Comment
IBIS-AMI Simulator	<i>Agilent ADS</i>
IBIS-AMI Simulator version	2011.10. TI strongly recommends updating to version 2011.10 or later to enable certain features such as retimer simulations. Earlier versions of ADS do not support all of the model functionalities and will produce erroneous simulation results
TI device models included	<a href="#">DS125BR401</a> Buffer Repeater
Other device models included	<i>None.</i> When interfacing to the DS125BR401, only generic TX/RX models were used. Customer will need to replace these with other vendors' models if desired.
Project names	<ul style="list-style-type: none"> <li>• <i>Agilent_ADS_2011.10.7zap</i>: ADS project using the DS125BR401 Repeater.</li> </ul>
Supported platforms	<ul style="list-style-type: none"> <li>• 32-bit Windows</li> <li>• 64-bit Windows</li> <li>• 64-bit Linux</li> </ul>

The topology implemented in the example project matches Figure 1 below. There are two main parts to this topology:

1. Link between a generic TX (pattern generator) and the DS125BR401 Repeater.
2. Link between the DS125BR401 Repeater and a generic RX (scope).

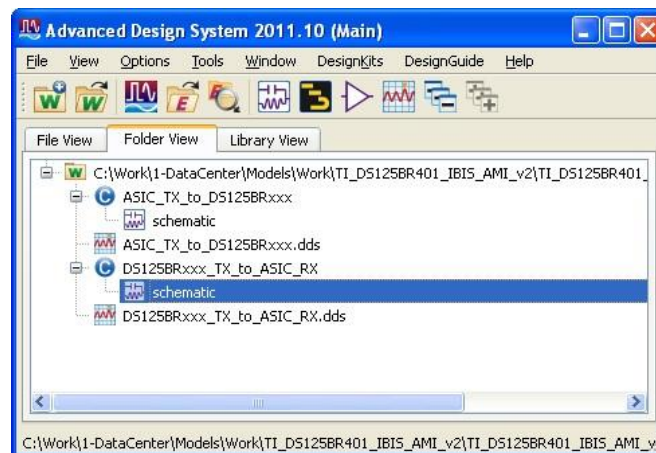


**Figure 1: Link topology for the DS125BR401 example project**

### 3 Project Quick Start Guide

The DS125BR401 example project included in this distribution contains two schematics, as shown in Figure 2:

- **ASIC\_TX\_to\_DS125BR401:** Link between a Generic ASIC TX model and the DS125BR401 Repeater. Contains a generic TX model *which should be replaced by the ASIC vendor's TX model*, a generic FR4 trace model *which should be replaced by actual channel*, and the DS125BR401 RX model.
- **DS125BR401\_TX\_to\_ASIC\_RX:** Link between the DS125BR401 Repeater and a generic receiver through a PCB board trace. Contains the DS125BR401 TX model, a generic FR4 trace model *which should be replaced by the actual channel*, and a generic RX model to represent an ASIC RX *which should be replaced by the ASIC vendor's RX model*.



**Figure 2: ADS main window showing the available schematics**

Between these two schematics the full link described in Figure 1 can be simulated and analyzed. The recommended procedure for simulating the enclosed example project is as follows:

1. Open the project. From the main ADS control window, select "File > Unarchive Workspace or Project", then browse to the project file provided with this release: Agilent\_ADS\_201110.7zap. ADS will ask you to name the project and specify where you want it to be placed.
2. Open the ASIC\_TX\_to\_DS125BR401 schematic and replace the generic TX IBISAMI model with the desired ASIC vendor TX model. This can be done by doubleclicking on the TX\_AMI model. Browse to and select the desired IBIS model to replace the generic TX model that is currently instantiated in the schematic. Note that this generic TX model does not contain any de-emphasis or amplitude control and is solely for the purpose of completing the simulation setup.

3. Replace the generic TX package model with the package model supplied by the ASIC TX vendor. Do this by double-clicking on the TX package s-parameter block and selecting the new s-parameter file. Note that the example ASIC TX package used in this schematic has a port ordering such that port 1 goes to port 3 and port 2 goes to port 4. If the package model supplied by the ASIC TX vendor has a different port ordering, then the schematic hook-up will need to be edited to make sure the signal propagates through the package and into the channel correctly.
4. Replace the generic FR4 trace model with your system's channel.

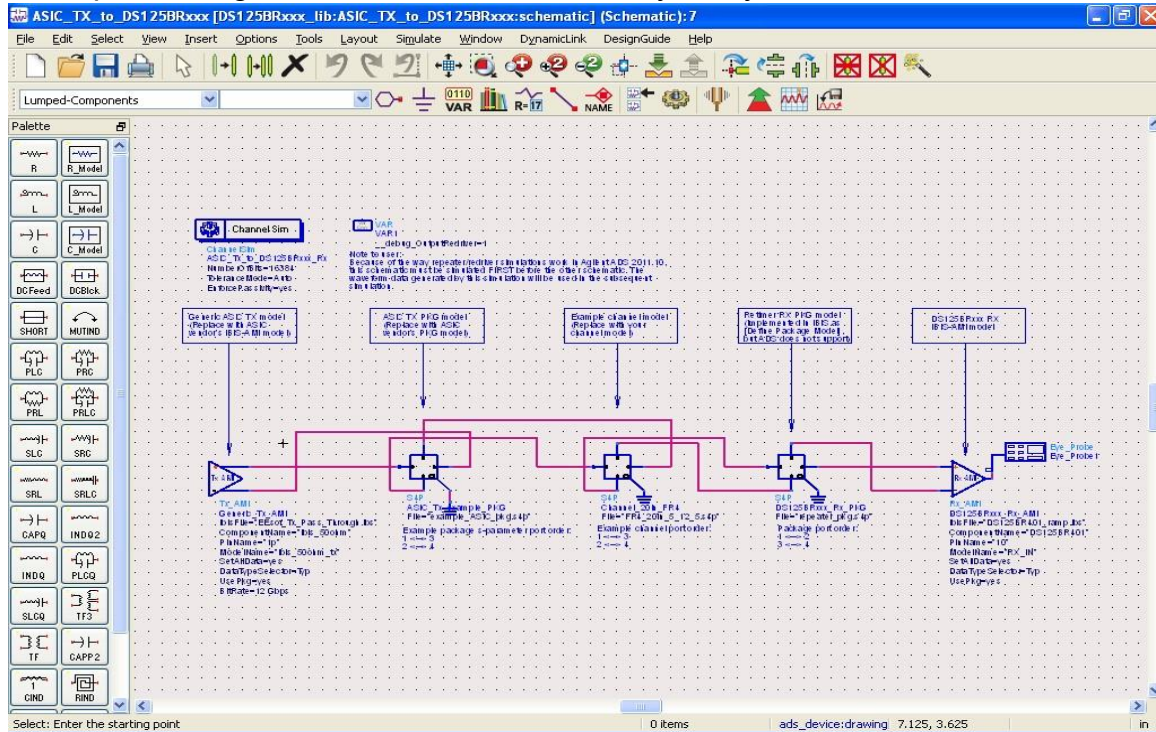


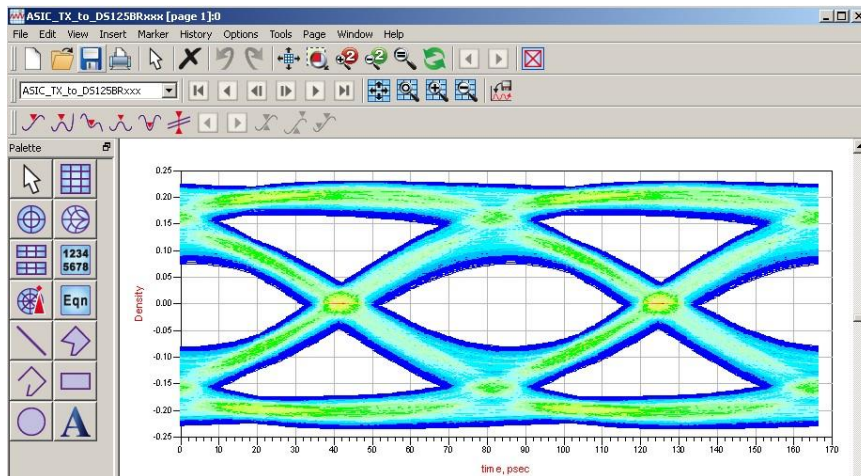


Figure 3: ASIC TX to DS125BR401 schematic (user should replace the items with arrows pointing to them)

5. Simulate the ASIC\_TX\_to\_DS125BR401 schematic by clicking on the  button. As the schematic is simulating ADS will display the simulation progress. Before simulating you can adjust the DS125BR401's equalizer settings by double-clicking on the DS125BR401 model and going to the AMI parameters tab. The EQ\_Level AMI parameter controls the CTLE setting. There are 16 integer settings (0 through 15) for the equalizer which correspond to the 16 combinations of CTLE settings shown in Table 2 of the DS125BR401 datasheet. Changing the EQ boost setting will have an effect on the output jitter/amplitude of the DS125BR401.

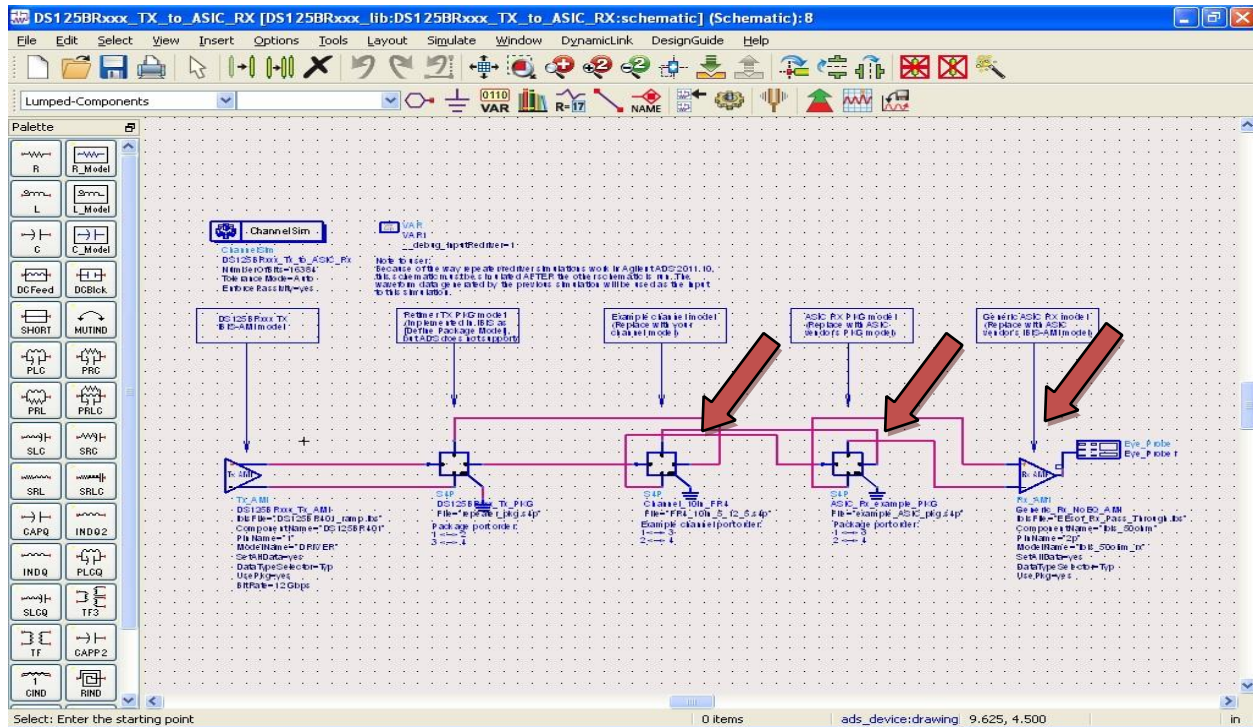
6. Once the simulation completes, the plot window will appear. To plot the resulting post-equalized eye, click on the  button and click again in the blank area to drop down a plot axis.
7. When the plot is inserted, the “Plot Traces & Attributes” window will open up. Select “Density” and then click on “>>Add>>”. Click “OK” to plot the eye.
8. The eye plot will appear in the plot window, as shown in Figure 4. Note that this is a plot of the eye as it appears after the DS125BR401’s equalization, but before the TX de-emphasis and VOD is applied.



**Figure 4: Eye plot for ASIC TX to DS125BR401 RX link**

9. Once the ASIC TX to DS125BR401 link has been simulated you can then open the DS125BR401\_TX\_to\_ASIC\_RX schematic and replace the generic RX IBISAMI model with the desired ASIC vendor RX model. This can be done by doubleclicking on the RX\_AMI model. Browse to and select the desired IBIS model to replace the generic RX model that is currently instantiated in the schematic.  
*Note that the generic RX model included in this project does not contain any equalization.*
10. Replace the generic RX package model with the package model supplied by the ASIC RX vendor. Do this by double-clicking on the RX package s-parameter block and selecting the new s-parameter file. Note that the example ASIC RX package used in this schematic has a port ordering such that port 1 goes to port 3 and port 2 goes to port 4. If the package model supplied by the ASIC RX vendor has a different port ordering, then the schematic hook-up will need to be edited to make sure the signal propagates through the package and into the channel correctly.
11. Replace the generic FR4 trace model with your system’s channel.





**Figure 5: DS125BR401 to ASIC RX schematic (user should replace the items with arrows pointing to them)**

12. Once the simulation completes, plot the eye (a.k.a. Density). Figure 6 shows an example eye plot at the output of the channel. The quality of the eye generated in this second simulation will be affected by:

- The CTLE setting (EQ\_Level) applied in the first simulation
- The output drive level (VOD\_Level) applied in the second simulation
- The output de-emphasis level (DE\_Level) applied in the second simulation.

The DS125BR401's TX parameters are controllable via the model-specific AMI parameters VOD\_Level and DE\_Level. Refer to the model user's guide (TI\_DS125BR401\_AMI\_model\_User\_Guide.pdf) for details on these parameters. The model-specific parameters are accessible by double-clicking on the TX\_AMI model and selecting the AMI tab, as shown in Figure 7.



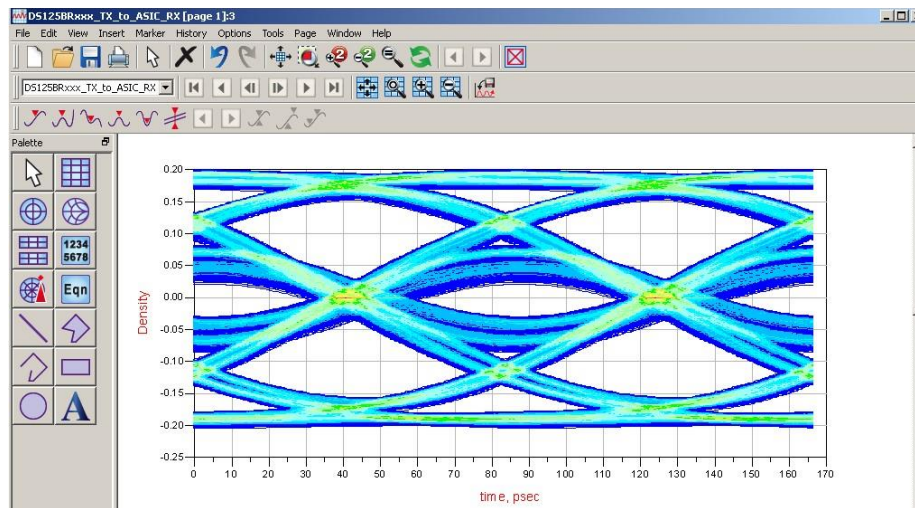


Figure 6: Example eye plot for DS125BR401 TX to ASIC RX input

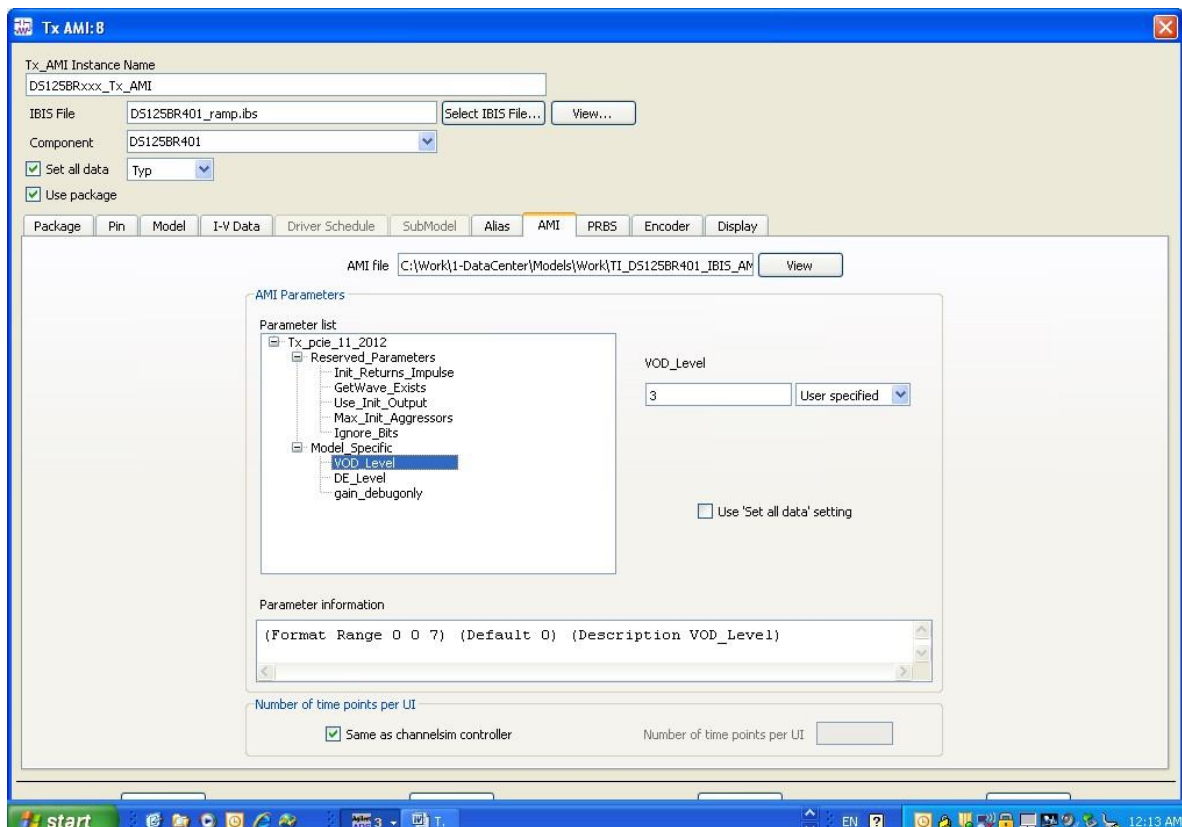


Figure 7: Edit the DS125BR401 TX parameters if desired

## 4 Suggestions and Tips

Simulations involving a configurable transmitter model and a configurable receiver model (especially if they originate from different IC vendors) often involve running multiple iterations in an attempt to identify the best settings. Here are some general tips for optimizing your simulations:

- ASIC TX to DS125BR401 Repeater direction
  - The following model-specific parameters will affect the eye shape: ASIC TX output amplitude, ASIC TX de-emphasis setting, DS125BR401 EQ boost setting (EQ\_Level), and DS125BR401 limit mode setting (Limit).
  - Generally speaking, an amplitude setting of 0.8V to 1.2V on the ASIC TX should be adequate for most channels.
  - The ASIC TX de-emphasis and DS125BR401 EQ boost settings may need to be co-optimized. In general, fixing the ASIC TX de-emphasis to a small negative value (i.e. -2dB to -4dB) or a value of zero will be adequate for the DS125BR401's robust equalizer.
  - Minimizing the jitter at the output of the DS125BR401 will improve the far-end eye.
  - For applications which involve link training (i.e. SAS-3 and 10GBASE-KR), the DS125BR401 must operate in a non-limiting mode so that the far-end Tx FIR coefficients can pass through the Repeater during link training. Set Limit=0 for such applications. If link training is not used in the application, set Limit=1.
- DS125BR401 Repeater to ASIC RX direction
  - The following model-specific parameters will affect the eye shape: DS125BR401 VOD\_Level and DS125BR401 DE\_Level.