TUSB1044 IBIS-AMI Models

User's Guide

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1 Introduction

This document describes the organization, structure, and proper usage of the TI TUSB1044 IBIS-AMI models (compiled and approved for external customer release), hereafter referred to as the “model” for short. The model is intended for use by the TUSB1044 design team and by TUSB1044 customers for system-level modeling and verification. This document assumes that you are familiar with the relevant IBIS-AMI modeling specifications.

1.1 Formatting Conventions

The help readability, various formatting conventions are used throughout this document:

- Hyperlinks to material within and outside this document are marked in blue.
- Courier font is used for `file names`, `code`, `variables`, `structures`, `parameters`, and `terminal commands`.

1.2 Charter of the SerDes IBIS-AMI models

The models are designed in accordance with the IBIS-AMI standard and attempt to model the significant characteristics of most components in the TUSB1044. The models are not intended to be an exact representation of TUSB1044 components implemented. Rather, the models seek to provide as high a degree of accuracy as is feasible outside of Spice-based models and simulations.

1.3 Is / Is Not Table

The following table describes the features and purposes of the models, as well as the limitations of the models.

Table 1: Model Is / Is Not Table

Is	Is Not
Compiled for 32-bit and 64 bit AMI EDA tool that run in Windows platform Compiled for 64-bit AMI EDA tool that run in Linux platform	Compiled for any other platform (i.e. 32-Linux)
Compliant to IBIS-AMI 5.0	Compliant to a more recent BIRD revisions, if they exist
Model of TUSB1044 functionality, non-idealities, and performance	*Exact representation of implemented components*

2 About This Release

2.1 IBIS-AMI Model Files

Table 2 shows the key IBIS-AMI model files delivered with the model release as part of the compressed archive.

Table 2: IBIS-AMI files included with the model release

File Name	Type	Description
TUSB1044_AMI_users_guide.pdf	PDF	TI TUSB1044 AMI model user's guide.
tusb1044_rxtx1.ibs	IBIS	Top-level IBIS wrapper for the Tx and Rx AMI model.
tusb1044_tx_v1.ami	AMI	Parameters file for the Tx model as required by the IBIS-AMI standard. This is a text file which is common for all OS/execution platforms.
tusb1044_tx_v1_x64.dll	DLL	Windows 64-bit compiled shared library for the Tx model. This shared library includes the AMI_Init, AMI_GetWave, and AMI_Close functions defined in the IBIS-AMI standard.
tusb1044_dc7_rx_v2.ami	AMI	Parameters file for the Rx model as required by the IBIS-AMI standard. This is a text file which is common for all OS/execution platforms.
tusb1044_dc7_rx_v3_x64.dll	DLL	Windows 64-bit compiled shared library for the Rx model. This shared library includes the AMI_Init, AMI_GetWave, and AMI_Close functions defined in the IBIS-AMI standard.
TUSB1044_TXTERM.s4p	s4p	Driver terminations to capture the output reflection and cross-couple signal between differential pair
TUSB1044_RXTERM.s4p	s4p	Input termination for input differential pair.
TUSB1044_ADS_release.7zads		Archieved ADS.7zads that contains a simple testbench in ADS.

2.2 DE and EQ AMI model specific parameters

TUSB1044 model consists of receiver and transmitter models. EDA tool is responsible for casecading the receiver to the transmitter to form a redriver to perform signal integrity analysis.

The following tables corresponding to Equalization and Deemphasis parameter settings.

Table 3. Model Specific Parameters for Receiver

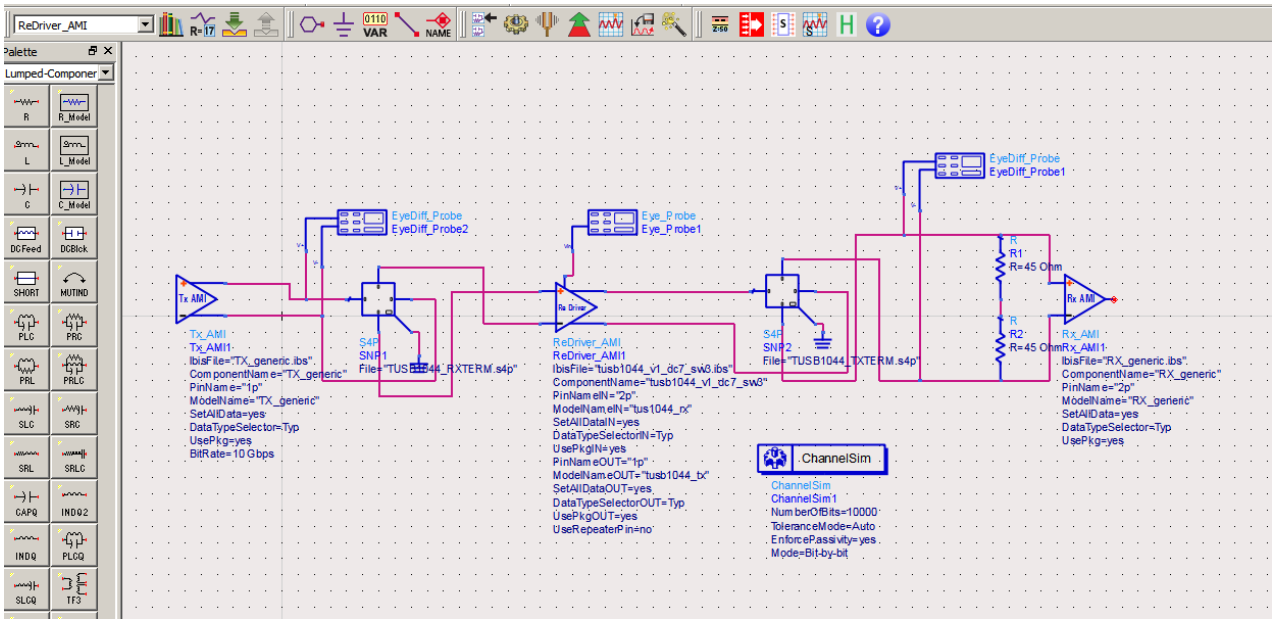
Parameter	Description and Setting
eq	0 to 15. Control the receiver equalization amount. Please see Table 3.1 for detail. Please note due to the nature of linear redriver, equalization setting will impact the driver characteristic as well.

Table 3.1 eq setting (please note receiver equalizer DC gain is set to 0 dB).

eq	dB	DEQ1 pin level	DEQ0 pin level
0	0.0	0	0
1	1.0	0	R
2	2.0	0	F
3	3.0	0	1
4	4.0	R	0
5	5.0	R	R
6	6.0	R	F
7	7.0	R	1
8	8.0	F	0
9	9.0	F	R
10	10.0	F	F
11	11.0	F	1
12	12.0	1	0
13	13.0	1	R
14	14.0	1	F
15	15.0	1	1

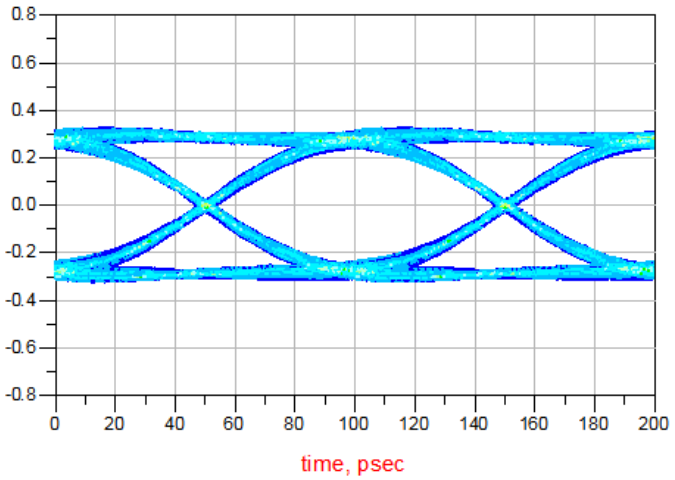
3 Model Simulation

Figure 1. Schematic of a system that consists of ideal transmitter, TUSB1044 redriver, and ideal receiver.



Please note that in ADS simulation set up , a user should NOT choose “Enforce Passivity” option in order to observe correct behavior after driver termination (TUSB1044_TXTERM.s4p). Otherwise unrealistic signal amplitude degradation can be observed, which doesn’t reflect true driver behavior.

Figure 2. Simulation Result for differential driver



4 ADS Simulation Setup Guide

4.1 Introduction

This section provides an overview of running TI IBIS-AMI models using Agilent's Advance Design System Software. For instructions on how to install the software, please refer to Agilent's Website.

4.2 Creating a new workspace

1. To create a new workspace in ADS, goto File -> New -> Workspace
2. Follow the new workspace wizard to create a new workspace
3. Enter the Project Name as 'XXXXX_wrk'
4. Instanciate a new schematic from the created workspace
5. Name the cell as 'cell_1' selecting the library as 'XXXXX_lib'
6. You can follow the wizard or manually place parts to create your required test bench

4.3 Schematic Creation

1. To insert any part in ADS schematic, goto Insert -> Component -> Component Library
2. Use search box to search for your required components and drag them to schematic
3. Search for Tx_AMI, Rx_AMI to insert Transmitter and Receiver IBIS-AMI Models
4. Insert S data blocks to link S4P files for Analog Impairments and differencial channels. Connect ground to the reference node.
5. Use ChannelSim component to create the required simulation envinorment
6. Insert eye probe to view the eye diagram, waveform and other measurements post simulation.
7. Create the schematic as shown in Figure 1 above

4.4 Importing IBIS and AMI files

1. To import the ibis files in ADS, double Tx_AMI or Rx_AMI components on the schematic, and browse for the respective IBIS files
2. User can view details of IBIS model from various information tabs after selecting the IBIS files for transmitter and receiver
3. ADS automatically links the *.ami and *.dll files associated with the *.ibs files

4.5 Importing S-Parameter models

1. To import the S-parameter files, double click S4P block and browse for the required .s4p files to instantiate into the schematic.
2. Repeat this method for all S4P blocks to import various .s4p files
3. Rearrange the wiring between Tx_AMI, S4P blocks and Rx_AMI components to match the required port order w.r.t .sp4 file

4.6 Simulation Settings

1. To access the simulation settings double click ChannelSim block.
2. User can change various simulation setting and parameters according to his need
3. Use help option to get detail understanding of varius parameters
4. To run the simulation, goto simuate -> Simulate
5. Refer to simulation status popup for various simulation warnings and errors during simulation

4.7 Simulation Results

1. Before running simulation, check for appropriate properties in eye probe for correct results
2. Set the data rate in parameters tab to the simulation bit rate as set in Tx_AMI's PRBS tab
3. In measurements tab, include all the required measurement options required to be recorded
4. In the popup after simulation, insert rectangular plot from palette panel and link density measurement to view the eye diagram. Refer Figure 2.

5. Use list from palette panel and link various other measurements in view in textual format