TUSB1146 IBIS-AMI Models

User's Guide

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1 Introduction

This document describes the organization, structure, and proper usage of the TI TUSB1146 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 TUSB1146 design team and by TUSB1146 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 TUSB1146. The models are not intended to be an exact representation of TUSB1146 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 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 TUSB1146 functionality, non-idealities, and performance	Exact representation of implemented components
Model for SSTX->TX1, RX1->SSRX and DP0->RX2 paths only	Does not model other paths
Based on measured data	
Only valid for typical conditions (27C, 3.3V and nominal process)	

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
TUSB1146_AMI_users_guide.pdf	PDF	TI TUSB1146 AMI model user's guide.
tusb1146.ibs	IBIS	Top-level IBIS wrapper for the TUSB1146 model.
RX2_TX.ami	AMI	Parameters file for the RX2 Tx model as required by the IBIS-AMI standard. This is a text file which is common for all OS/execution platforms.
RX2_TX_x64.dll	DLL	Windows 64-bit compiled shared library for the RX2 Tx model. This shared library includes the AMI_Init, AMI_GetWave, and AMI_Close functions defined in the IBIS-AMI standard.
RX2_TX_x64.so	SO	Linux 64-bit compiled shared object library for the RX2 Tx model. This shared library includes the AMI_Init, AMI_GetWave, and AMI_Close functions defined in the IBIS-AMI standard.
DP0_RX.ami	AMI	Parameters file for the DP0 Rx model as required by the IBIS-AMI standard. This is a text file which is common for all OS/execution platforms.
DP0_RX_x64.dll	DLL	Windows 64-bit compiled shared library for the DP0 Rx model. This shared library includes the AMI_Init, AMI_GetWave, and AMI_Close functions defined in the IBIS-AMI standard.
DP0_RX_x64.so	SO	Linux 64-bit compiled shared object library for the DP0 Rx model. This shared library includes the AMI_Init, AMI_GetWave, and AMI_Close functions defined in the IBIS-AMI standard.
SSRX_TX.ami	AMI	Parameters file for the SSRX Tx model as required by the IBIS-AMI standard. This is a text file which is common for all OS/execution platforms.
SSRX_TX_x64.dll	DLL	Windows 64-bit compiled shared library for the SSRX Tx model. This shared library includes the AMI_Init, AMI_GetWave, and AMI_Close functions defined in the IBIS-AMI standard.
SSRX_TX_x64.so	SO	Linux 64-bit compiled shared object library for the SSRX Tx model. This shared library includes the AMI_Init, AMI_GetWave, and AMI_Close functions defined in the IBIS-AMI standard.

RX1_RX.ami	AMI	Parameters file for the RX1 Rx model as required by the IBIS-AMI standard. This is a text file which is common for all OS/execution platforms.
RX1_RX_x64.dll	DLL	Windows 64-bit compiled shared library for the RX1 Rx model. This shared library includes the AMI_Init, AMI_GetWave, and AMI_Close functions defined in the IBIS-AMI standard.
RX1_RX_x64.so	SO	Linux 64-bit compiled shared object library for the RX1 Rx model. This shared library includes the AMI_Init, AMI_GetWave, and AMI_Close functions defined in the IBIS-AMI standard.
TX1_TX.ami	AMI	Parameters file for the TX1 Tx model as required by the IBIS-AMI standard. This is a text file which is common for all OS/execution platforms.
TX1_TX_x64.dll	DLL	Windows 64-bit compiled shared library for the TX1 Tx model. This shared library includes the AMI_Init, AMI_GetWave, and AMI_Close functions defined in the IBIS-AMI standard.
TX1_TX_x64.so	SO	Linux 64-bit compiled shared object library for the TX1 Tx model. This shared library includes the AMI_Init, AMI_GetWave, and AMI_Close functions defined in the IBIS-AMI standard.
SSTX_RX.ami	AMI	Parameters file for the SSTX Rx model as required by the IBIS-AMI standard. This is a text file which is common for all OS/execution platforms.
SSTX_RX_x64.dll	DLL	Windows 64-bit compiled shared library for the SSTX Rx model. This shared library includes the AMI_Init, AMI_GetWave, and AMI_Close functions defined in the IBIS-AMI standard.
SSTX_RX_x64.so	SO	Linux 64-bit compiled shared object library for the SSTX Rx model. This shared library includes the AMI_Init, AMI_GetWave, and AMI_Close functions defined in the IBIS-AMI standard.
TUSB1146_wrk.7zADS	ADS workspace	Sample ADS simulation workspace – includes sample testbenches (see Figure 1) for the repeater.

2.2 AMI model specific parameters

TUSB1146 model consists of receiver and transmitter models. The EDA tool cascades the receiver and transmitter to form a redriver for signal integrity analysis.

The following table corresponds to receiver and transmitter parameter settings.

Table 3. Model Specific Parameters

Parameter	Description and Setting
EQ	0 to 15. 0 is lowest EQ and 15 is highest EQ setting. Controls the DP0, RX1 and SSTX receiver equalizer. Please refer to the datasheet for parameter values
VOD	0 to 3. 0 is highest VOD and 3 is lowest VOD setting. Controls the TX1, SSRX and RX2 transmitter VOD linearity setting. Please refer to the datasheet for parameter values
EN_LIMIT	0 or 1. 0 is linear enabled. 1 is limited enabled. Controls the SSRX transmitter – linear (0) or limiting (1) mode
EN_DE	0 or 1. 0 is de-emphasis disabled. 1 is de-emphasis enabled. Enables the SSRX transmitter de-emphasis when in limiting mode
EN_PRE	0 or 1. 0 is pre-shoot disabled. 1 is pre-shoot enabled. Enables the SSRX transmitter pre-shoot when in limiting mode
DE	0 to 3. 0 is lowest de-emphasis level and 3 is highest de-emphasis level. Sets the SSRX transmitter de-emphasis level Please refer to the datasheet for parameter values
PRE	0 to 3. 0 is lowest pre-shoot level and highest pre-shoot level. Sets the SSRX transmitter pre-shoot level Please refer to the datasheet for parameter values
Corner	Typical corner only.

3 Model Simulation in ADS

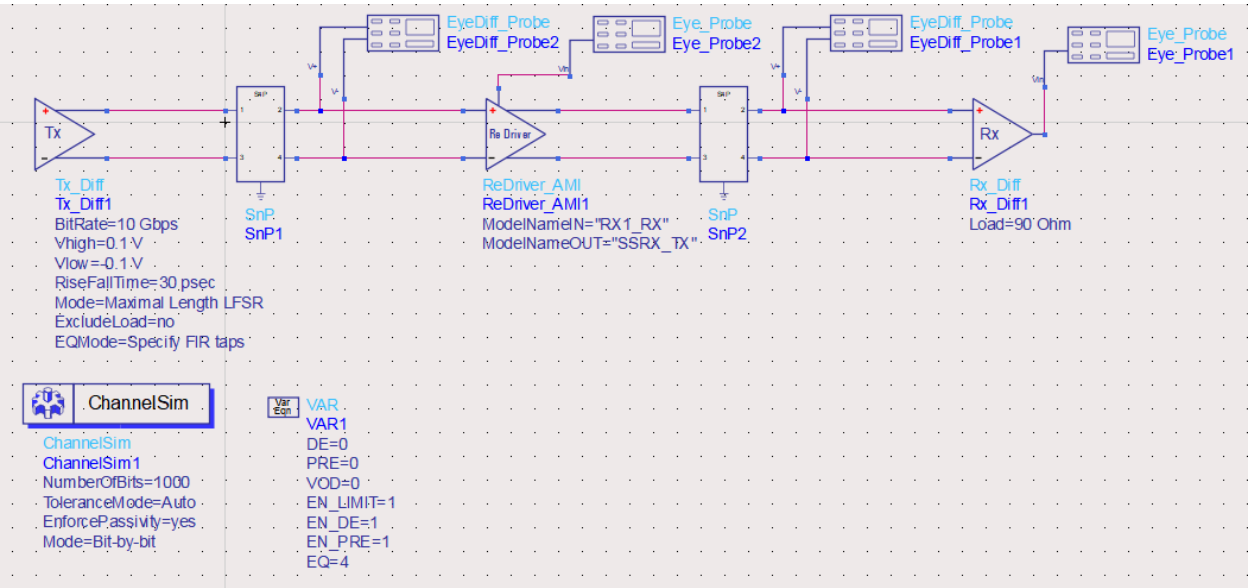

Figure 1: ADS schematic of a simulation testbench for the RX1 to SSRX channel. The testbench includes an ideal transmitter, TUSB1146 redriver (RX1_RX and SSRX_TX) and ideal termination (receiver). The channel between the transmitter and the repeater inserts ~12dB loss at 5GHz.

Note: The SamplesPerBit should be set to 100 for correct behavior (SampleRate 100e10 for 10Gbps).

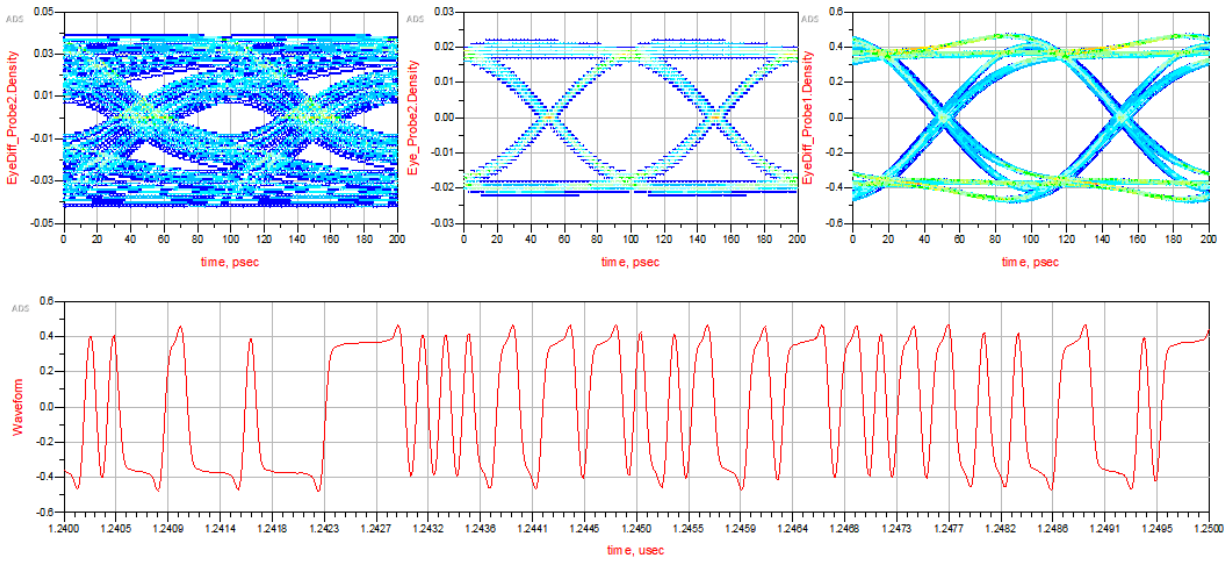

Figure 2: Simulation results using the following settings : EQ=4, VOD=0, EN_LIMIT=1, EN_DE=EN_PRE=1 and DE=PRE=0. Eye diagrams are at the input to the repeater, within the repeater after equalization and at the output of the repeater. The waveform is at the output of the repeater.