TEXAS INSTRUMENTS

Application Note
Document version: 00.02.000 — March 2024

DS125DF1610 IBIS-AMI Models

User's Guide

Version 00.02.00
March 2024
Copyright © 2017, Texas Instruments Incorporated. All rights reserved.

The information and/or drawings set forth in this document and all rights in and to inventions disclosed herein and patents which might be granted thereon disclosing or employing the materials, methods, techniques, or apparatus described herein are the exclusive property of Texas Instruments. No disclosure of information or drawings shall be made to any other person or organization without the prior consent of Texas Instruments.

Disclaimer

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, modifications, enhancements, improvements, and other changes to its products and services at any time and to discontinue any product or service without notice. Customers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All products are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its hardware products to the specifications applicable at the time of sale in accordance with TI's standard warranty. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by government requirements, testing of all parameters of each product is not necessarily performed.

TI assumes no liability for applications assistance or customer product design. Customers are responsible for their products and applications using TI components. To minimize the risks associated with customer products and applications, customers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any TI patent right, copyright, mask work right, or other TI intellectual property right relating to any combination, machine, or process in which TI products or services are used. Information published by TI regarding third-party products or services does not constitute a license from TI to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. Reproduction of this information with alteration is an unfair and deceptive business practice. TI is not responsible or liable for such altered documentation.

Resale of TI products or services with statements different from or beyond the parameters stated by TI for that product or service voids all express and any implied warranties for the associated TI product or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

TI is a trademark of Texas Instruments Incorporated.

© 2017, Texas Instruments Incorporated. All rights reserved.

Table of Contents

The TI IBIS-AMI models contain information on products that is based on high-level specifications. These may not accurately represent the product design in all cases. Please verify the accuracy of the models with TI before using the results.

1 Introduction

This document describes the organization, structure, and proper usage of the TI DS125DF1610 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 DS125DF1610 design team and by DS125DF1610 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 DS125DF1610. The models are not intended to be an exact representation of DS125DF1610 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 any other platform (Linux)
Compliant to IBIS-AMI 6.0	Compliant to a more recent BIRD revisions, if they exist
Model of DS125DF1610 functionality, non-idealities, and performance	Exact representation of implemented components

The TI IBIS-AMI models contain information on products that is based on high-level specifications. These may not accurately represent the product design in all cases. Please verify the accuracy of the models with TI before using the results.

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
ds125df1610_AMI_users_guide.pdf	PDF	TI DS125DF1610 AMI model user's guide.
ds125df1610.ibs	IBIS	Top-level IBIS wrapper for the Tx and Rx AMI model.
ds125df1610_tx.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.
ds125df1610_tx_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.
ds125df1610_rx.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.
ds125df1610_rx_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.
DS125DF1610.7zads		ADS demo project lincluding package and transmission line models

The TI IBIS-AMI models contain information on products that is based on high-level specifications. These may not accurately represent the product design in all cases. Please verify the accuracy of the models with TI before using the results.

2.2 Retimer AMI model specific parameters

DS125DF1610 is a retimer that consists of receiver and transmitter. The ibs file has included the pre AMI standard adopted repeater_pin syntax. EDA tool that supports the repeater_pin syntax are capable to fully simulate the function of this retimer AMI model. EDA tool that do not support repeater_pin syntax can simulate this retimer AMI model as a transmitter and a receiver respectively.

The following settings correspond to the following values for this model.

Table 3. Model Specific Parameters for Transmitter

VOD DEM	Magnitude of output signal De-emphasis attenuation
edge	Edge rate control. 0 through 7
c0s cps cns	Main cursor sign, 1 is positive -1 is negative Post cursor sign, 1 is positive -1 is negative Pre cursor sign, 1 is positive -1 is negative
mainn pren postn	Main cursor tap, range from 0 to 63 Pre cursor tap, range from 0 to 63 Post cursor tap, range from 0 to 63
corner	PVT corner model selector. -1 slow; 0 typ; 1 fast. Currently, only typ enabled

Table 4. Model Specific parameters for Receiver

gain	VGA gain. 0,1,2,3. 0 is low gain and 3 is highest gain
bw	CTLE bandwidth. -1, 0, 1 for min, mid, max
CTLEAdapt	1 turns on the auto adaptation. 0 to set the ctle setting through CTLE
EQ	Work in conjunction with ctleAdapt =0 to set the CTLE. 0 has the least equalization and 31 has highest equalization. Setting 32 enables eq_BSTx to be active.
EOM_Window	This is the number of bits to be evaluated by the receiver before it makes an adjustment. The default value 1000 is based on empirical data that optimize the runtime and still give good accuracy as the hardware implementation. User can increase this value in the penalty of receiver taking more number of bits to reach steady-state.
DFEAdapt	1 turn on the auto adaptaion for DFE 0 to set the DFE taps values through DFEtap1 to DFEtap5
Rx_config	Allows observation of CTLE output before slicer
corner	PVT corner model selector. -1 slow; 0 typ; 1 fast. Currently, only typ enabled
eq_BST0	Manually set Boost 0 (range 0:3)
eq_BST1	Manually set Boost 1 (range 0:3)
eq_BST2	Manually set Boost 2 (range 0:3)
eq_BST3	Manually set Boost 3 (range 0:3)

3 Model Simulation

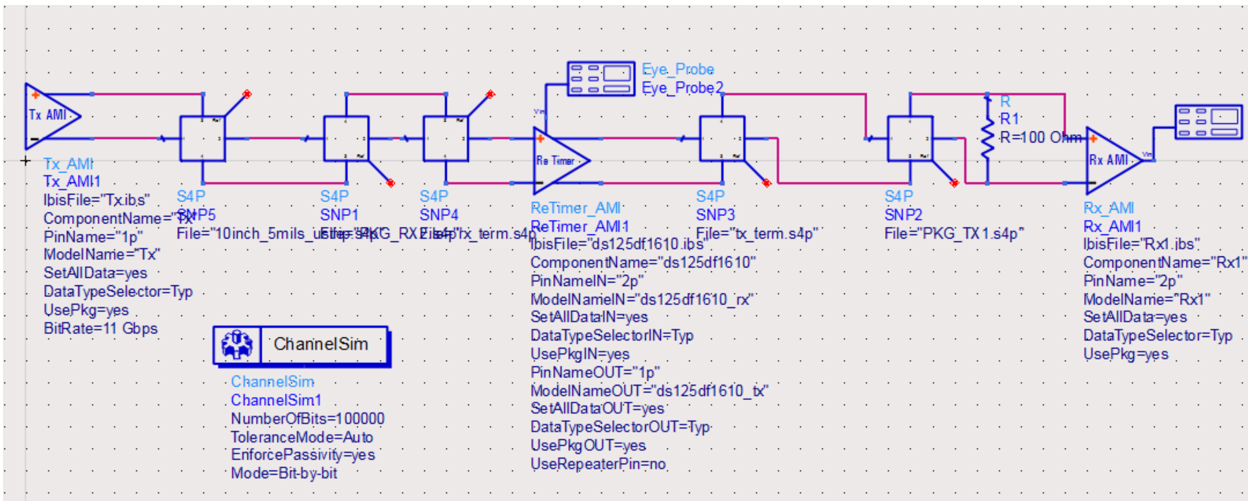

Figure 1. Schematic of a system that consists of ideal transmitter, DS125DF1610 retimer, and ideal receiver.

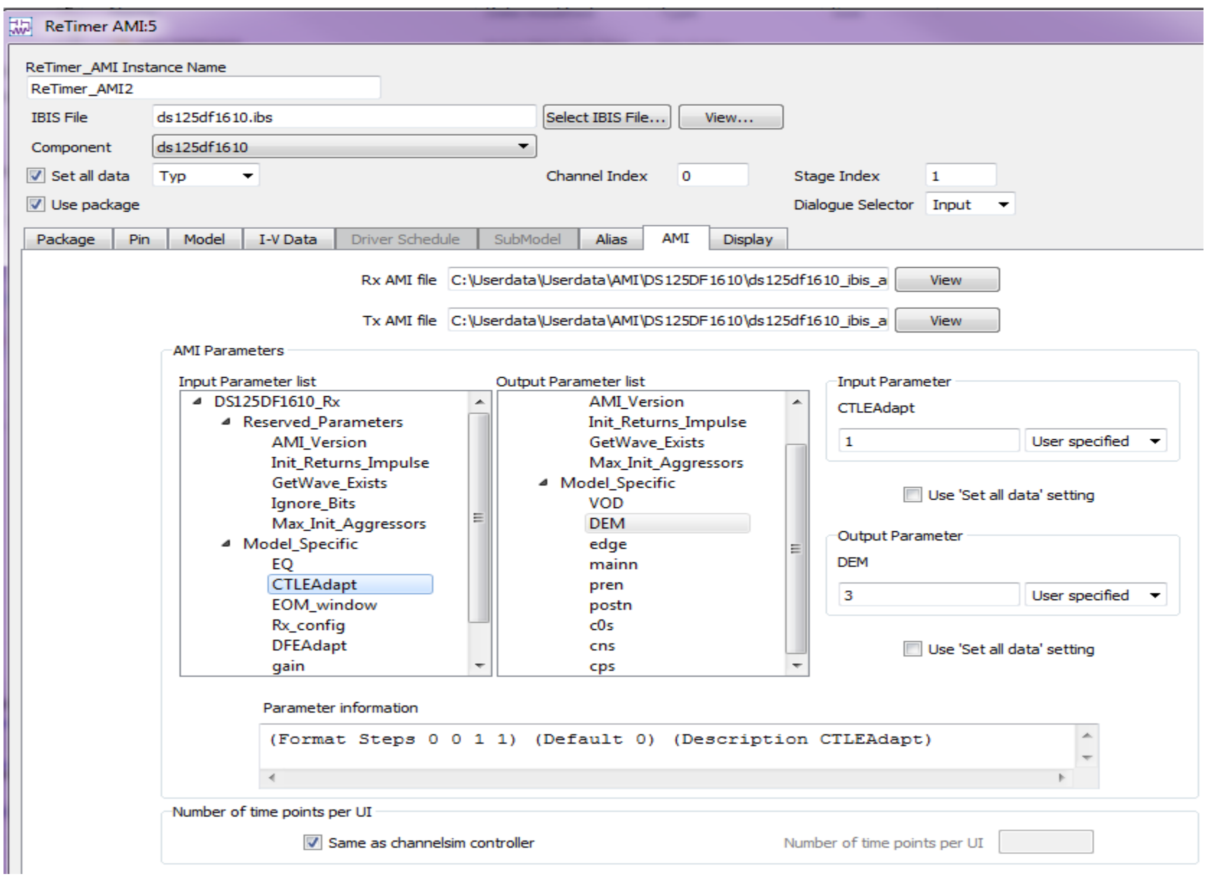

Figure 2. Double click on the retimer schematic to set the Model Specific parameters

The TI IBIS-AMI models contain information on products that is based on high-level specifications. These may not accurately represent the product design in all cases. Please verify the accuracy of the models with TI before using the results.

4 Model Caveats

1) Due to the complexity of the adaptation loops of DS125DF1610 high-speed system, it requires about 20 minutes to run 1 millions bit in time-domain simulation for 32 samples per bit setting. Faster execution time can be achieved by reducing resolution to 16 samples per bit but with the possibility of compromised accuracy.
    a) Simulation benchmarked on laptop running Intel i7-4810MQ @ 2.8GHz.

The TI IBIS-AMI models contain information on products that is based on high-level specifications. These may not accurately represent the product design in all cases. Please verify the accuracy of the models with TI before using the results.