

DAC38J84 IBIS-AMI Models

User's Guide

Version 00.01.00

March 2014

Copyright © 2014, 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.

Texas Instruments Proprietary Information

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.

© **Error! Reference source not found.**¹⁴, Texas Instruments Incorporated. All rights reserved.

Table of Contents

1	Introduction	4
1.1	Formatting Conventions.....	4
1.2	Charter of the SerDes IBIS-AMI models	4
1.3	Is / Is Not Table	4
2	About This Release	5
2.1	IBIS-AMI Model Files	5
2.2	TX and RX AMI model specific parameters	6
3	Model Simulation.....	8
3.1	ADS 2013.06 User's Guide.....	8
4	ADS Simulation Setup Guide.....	10
4.1	Introduction.....	10
4.2	Creating a new workspace.....	10
4.3	Schematic Creation	10
4.4	Importing IBIS and AMI files	11
4.5	Importing S-Parameter models	11
4.6	Simulation Settings.....	11
4.7	Simulation Results.....	11

1 Introduction

This document describes the organization, structure, and proper usage of the TI DAC38J84 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 DAC38J84 design team and by DAC38J84 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 DAC38J84. The models are not intended to be an exact representation of DAC38J84 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 AMI EDA tool that run in Windows platform	Compiled for any other platform (i.e. 32- or 64-bit Linux)
Compliant to IBIS-AMI 5.0	Compliant to a more recent BIRD revisions, if they exist
Model of DAC38J84 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
DAC38J84_AMI_users_guide.pdf	PDF	TI DAC38J84 AMI model user's guide.
DAC38J84.ibs	IBIS	Top-level IBIS wrapper for the Tx and Rx AMI model.
DAC38J84_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.
DAC38J84_Tx.dll	DLL	Windows 32-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.
DAC38J84_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.
DAC38J84_Rx.dll	DLL	Windows 32-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.
rincewind_40nm_rw3_txdac_n_0 p90_1p50_027_nomR.s4p rincewind_40nm_rw3_txdac_s_1 p10_1p98_125_minR.s4p rincewind_40nm_rw3_txdac_w_0 p79_1p33_125_maxR.s4p	S4P	Analog impairment for transmitter model for 3 corners
ADS demo project	ZIP	DAC38J84_wrk

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 TX and RX AMI model specific parameters

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

Table 3. Model Specific Parameters for Transmitter

Pre	0 = 0% 1 = -2.5% 2 = -5.0% 3 = -7.5%	4 = -10.0% 5 = -12.5% 6 = -15.0% 7 = -17.5%
Swing	0 = 795mV 1 = 830mV 2 = 870mV 3 = 905mV 4 = 940mV 5 = 975mV 6 = 1010mV 7 = 1045mV	8 = 1080mV 9 = 1110mV 10 = 1145mV 11 = 1175mV 12 = 1200mV 13 = 1230mV 14 = 1255mV 15 = 1275mV
pst1	0 = 0% 1 = 2.5% 2 = 5.0% 3 = 7.5% 4 = 10.0% 5 = 12.5% 6 = 15.0% 7 = 17.5% 8 = 20.0% 9 = 22.5% 10 = 25.0% 11 = 27.5% 12 = 30.0% 13 = 32.5% 14 = 35.0% 15 = 37.5%	16 = 0% 17 = -2.5% 18 = -5.0% 19 = -7.5% 20 = -10.0% 21 = -12.5% 22 = -15.0% 23 = -17.5% 24 = -20.0% 25 = -22.5% 26 = -25.0% 27 = -27.5% 28 = -30.0% 29 = -32.5% 30 = -35.0% 31 = -37.5%

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.

Table 4. Model Specific parameters for Receiver

CDR_Threshold (Tracking Rate)	0 = 313 ppm 1 = 607 ppm 2 = 723 ppm 3 = 868 ppm 4 = 96 ppm 5 = 289 ppm 6 = 434 ppm 7 = 13 ppm
anlg_eql_gaincode	-1 (Adapt) or 0:15 Rx Analog equalizer gaincode. The default value is set to -1 (Adapt) which lets the analog equalizer adapt to the optimal setting (both gaincode & zerocode). If the user chooses any value between 0 and 15, then the equalizer will NOT adapt and the chosen gain code value will be applied. 0 is Max Equalization and 15 is No Equalization.
anlg_eql_zerocode	0:7 0 is Max Zero Frequency (365MHz) and 7 is Min (50MHz) Zero Frequency. Default value is 0. Ignored if anlg_eql_gaincode = -1 (Adapt)
anlg_eql_gainboost	0,1 0 is gain boost turned off and 1 is gain boost turned on. Default value is 0.
corner	0 Nominal Corner 1 Fast Corner 2 Slow Corner

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.

3 Model Simulation

This section guides the user through the simulation of the IBIS-AMI model.

- a. SamplesPerBit is ideally set to 48 as the CDR has 48 interpolators. User can compromise the accuracy for the speed by reducing the SamplesPerBit. However, it is recommended to set the SamplesPerBit greater or equal to 16 bit.
- b. Minimum Ignore Bits should be set to equal or larger than 1000000 bits to give adequate time for CDR and DFE and other adaptation loops to reach their steady states.

3.1 ADS 2013.06 User's Guide

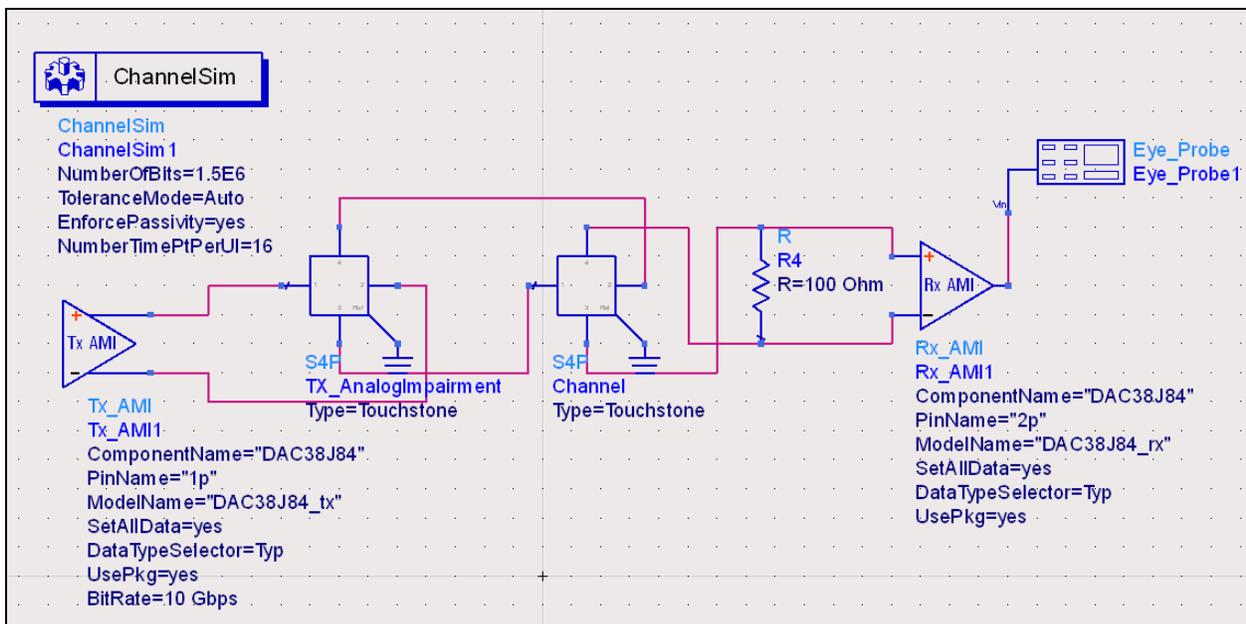
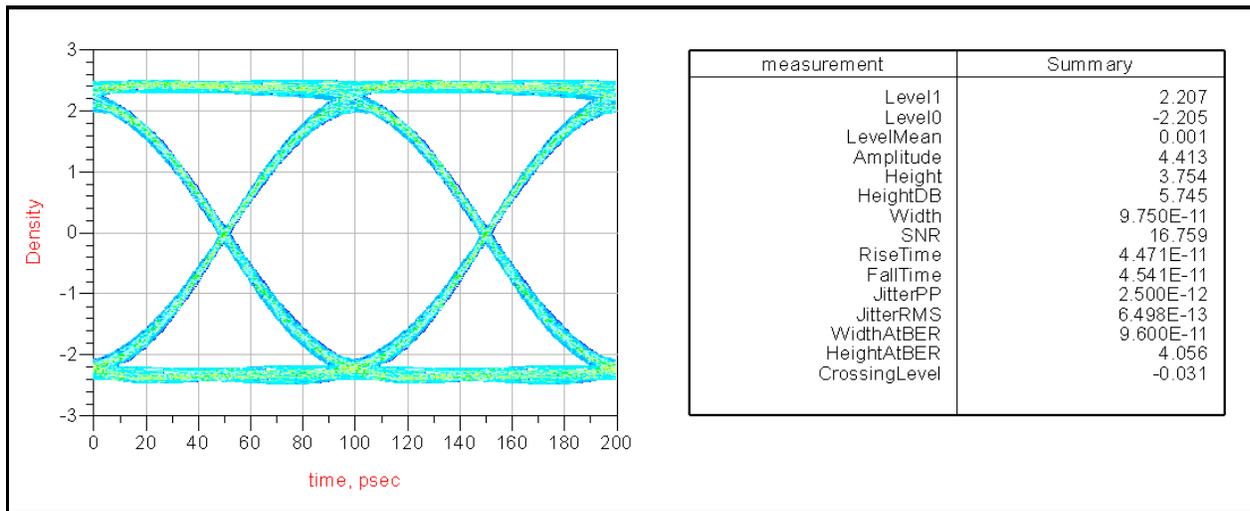


Figure 1. Schematic for ADS

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.



**Figure 2. Eye Diagram & Summary chart in ADS (Tx Settings: pre1=0; post1=0; swing=0
 Rx Settings: CDR_Threshold=0; anlg_eql_gaincode=0; anlg_eql_zero=0; anlg_eql_gainboost =0;
 corner=0)**

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 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 'DAC38J84_wrk'
4. Instanciate a new schematic from the created workspace
5. Name the cell as 'cell_1' selecting the library as 'DAC38J84_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 differential channels. Connect ground to the reference node.
5. Use ChannelSim component to create the required simulation environment
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

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.

4.4 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 various parameters
4. To run the simulation, goto simulate -> 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