GS6080 IBIS-AMI Model

User Guide

1. Introduction

The GS6080 is a high-speed BiCMOS integrated circuit designed to drive one or two 75Ω coaxial cables. The GS6080 may drive data rates up to 5.94Gb/s and provides two selectable slew rates in order to achieve compliance to SMPTE ST 424, SMPTE ST 292, and SMPTE ST 259. This document describes the contents, features, and use of the GS6080 IBIS-AMI model. The model includes the equalizer and swing settings of the GS6080 and facilitates simulation of the transmitter (Tx) and Receiver (Rx) in EDA platforms compliant with IBIS 6.0.

2. GS6080 IBIS-AMI Model

The GS6080 IBIS-AMI model is an IBIS redriver model comprised of RX and TX models. The Rx model applies equalization to a signal received from an upstream channel and retransmits it it to a downstream channel using the Tx model. Figure 2-1 shows the block diagram of a sample test bench to simulate the GS6080 IBIS-AMI model.

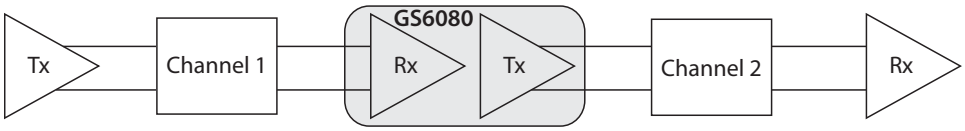

Figure 2-1: Test Bench Block Diagram for GS6080 IBIS AMI Models (Redriver Configuration)

2.1 GS6080 Receiver IBIS-AMI Model

The GS6080 Receiver IBIS-AMI model consists of three parts: (1) the Analog Termination IBIS model, (2) the Receiver AMI model and (3) the QFN package model. The block diagram in Figure 2-2 shows the sequence of signal flow and the individual parts of the model. The external S-parameter file for the QFN Package model extends the accuracy of the package effects beyond what can be described by R, L and C components in the current IBIS 6.0 standard. The external S-parameter data is processed as part of the channel by the EDA platform.

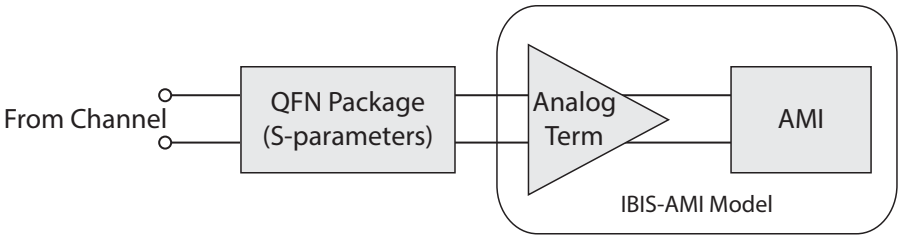

Figure 2-2: GS6080 Receiver IBIS-AMI Model

2.1.1 GS6080 Receiver IBIS Model

The receiver IBIS model provides the characterized GS6080 Receiver input termination which is used by the EDA platform to determine the time-domain impulse response for the channel. The model is based on a single-ended non-inverting characterization of the GS6080 Receiver and the EDA platform develops a differential model from complimentary copies of the single-ended model. Note that the IBIS model contains only the DC termination impedance of the receiver as I-V tables in the IBIS file. Frequency dependent simulation (e.g., return loss) using the IBIS file is not accurate.

2.1.2 GS6080 Receiver AMI Model

The GS6080 Receiver AMI model includes a trace equalizer to compensate for PCB trace losses. The trace equalizer can be turned on or off by using the EQ_EN_b parameter as shown in Table 2-1. The function of the EQ_EN_b parameter is equivalent to the $\overline{\text{EQ\_EN}}$ pin on the GS6080 device.

Note: This feature is not supported in SD mode and must be disabled when simulating in SD mode

Table 2-1: EQ_EN_b Parameter in Receiver AMI Model

EQ_EN_b	Function
0	3dB Trace Equalization ON
1	3dB Trace Equalization OFF (default)

2.1.3 GS6080 Receiver Package Model

The GS6080 QFN package model is provided as a 4-Port S-parameter file (GS6080_RX_Pkg.s4p) in standard touchstone format from 0 to 15GHz. It is recommended to use this package model (with the "GS6080.ibs" file) as part of the simulation circuit for increased accuracy, especially at data rates above 3Gb/s. Figure 2-3 illustrates the mapping of the touchstone file ports between the GS6080 die and package pins.

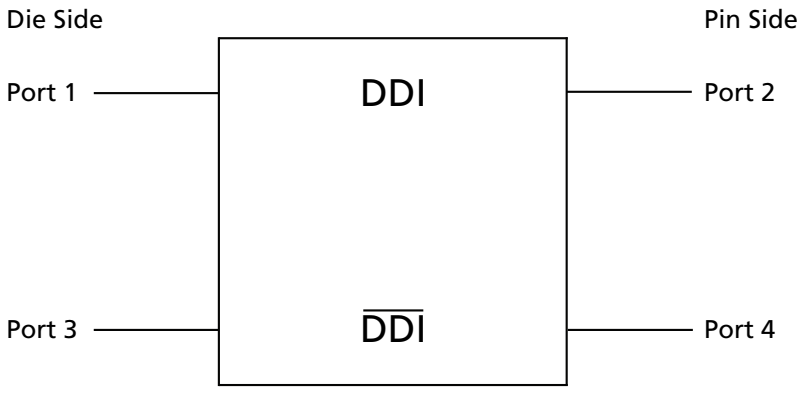

Figure 2-3: GS6080 Receiver Touchstone Package Model Port Mapping

If the s-parameter package model cannot be used in simulation, the alternative "GS6080_RLC.ibs" IBIS file may be used. The "GS6090_RLC.ibs" file includes a lumped RLC package model of the GS6080.

2.2 GS6080 Transmitter IBIS-AMI Model

The GS6080 Transmitter IBIS-AMI model consists of three parts: (1) the Analog Driver IBIS model, (2) the Transmitter AMI model, and (3) the QFN package model. The block diagram in Figure 2-4 shows the sequence of the signal flow and the individual parts of the model.

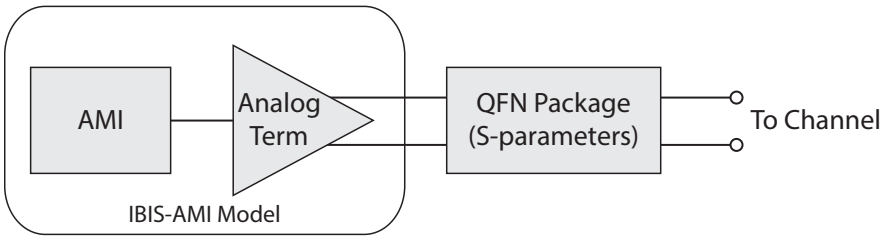

Figure 2-4: GS6080 Transmitter IBIS-AMI Model

2.2.1 GS6080 Analog Driver IBIS Model

The Analog Driver IBIS model receives processed signal information from the Transmitter AMI model and applies the analog characteristics of the GS6080 Transmit driver. Two sub-models are available, supporting for different output slew rates. The appropriate sub-model can to be selected in the EDA software.

Table 2-2 shows the relationship between the SD_EN pin setting of the GS6080 and the appropriate IBIS sub-model.

Table 2-2: Sub-Model Selection Based on the Output Slew Rate

SD_EN	Rise / Fall Time	Sub-model
0	SMPTE 424M & 292M compliant	sdo_HD
1	SMPTE 259M compliant	sdo_SD

Note that the IBIS model contains only the DC termination impedance of the transmitter as I-V tables in the IBIS file. Frequency dependent simulation (e.g. return loss) using the IBIS file is not accurate. It is recommended to use the "GS6080_TX_Term.s2p" S-parameter file instead of the IBIS file for output return loss (ORL) simulations. Figure 2-5 shows an example schematic for simulating ORL with the GS6080_TX_Term.s2p file.

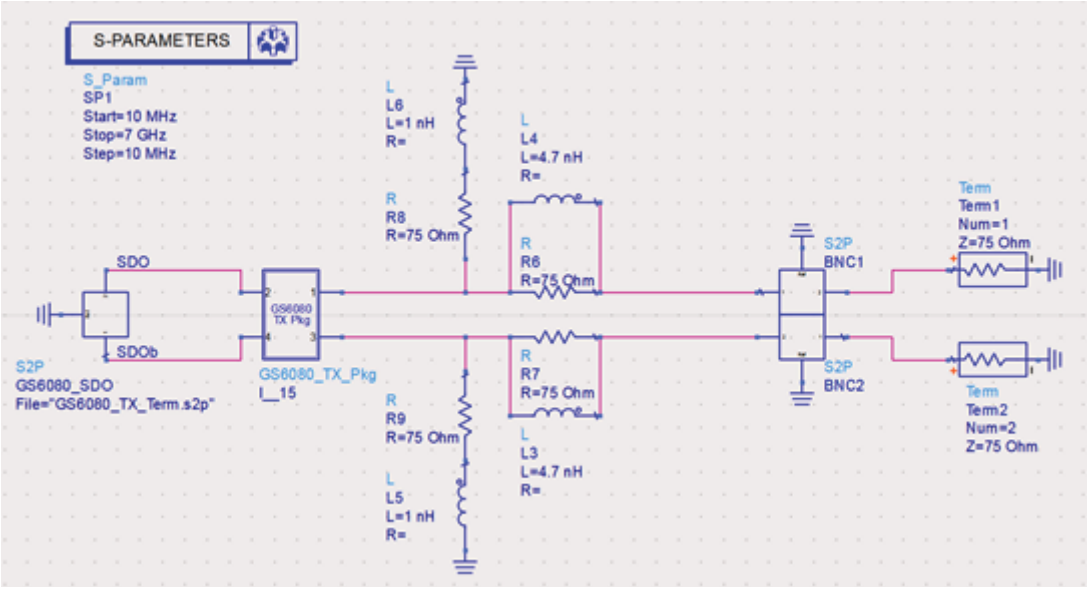

Figure 2-5: GS6080 Output Return Loss Simulation Setup

2.2.2 GS6080 Transmitter AMI Model

The GS6080 Transmitter AMI model includes an RSET model-specific parameter to control the driver swing. This parameter has the same function as the RSET resistor for the GS6080 device. For a typical 800mV$_{pp}$ output, RSET should be set to 750Ω. The RSET parameter range is from 1.21kΩ to 576Ω which translates to 500mV$_{pp}$ to 1040mV$_{pp}$ output swing. The relationship between the RSET value and the output swing is given by the following equation:

$$\mathbf{RSET} = 8 \times \left(\frac{\mathbf{R_{term}}}{\mathbf{V_{outppSE}}} \right)$$

Where R_{term} is the value of the termination resistors and $V_{outppSE}$ is the single-ended output voltage swing. For more information regarding the RSET resistor, please refer to the GS6080 Data Sheet.

2.2.3 GS6080 Transmitter Package Model

As stated in Section 2.2, a differential model is provided for the GS6080 transmitter. The GS6080 QFN package model is provided as a 4-Port S-parameter file (GS6080_TX_Pkg.s4p) in standard touchstone format from 0 to 15GHz. It is recommended to use this package model (with the "GS6080.ibs" file) as part of the simulation circuit for increased accuracy, especially at data rates above 3Gb/s. Figure 2-6 illustrates the mapping of the touchstone file ports between the GS6080 die and package pins.

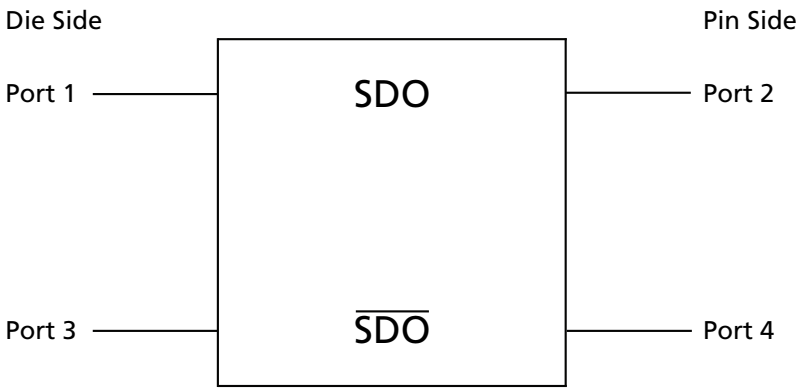

Figure 2-6: GS6080 Transmitter Touchstone Package Model Port Mapping

If the s-parameter package model cannot be used in simulation, the alternative "GS6080_RLC.ibs" IBIS file may be used. The "GS6080_RLC.ibs" file includes a lumped RLC package model of the GS6080.

Note: The package model does not include the application circuit. An appropriate application circuit must be used in the simulation circuit with the IBIS-AMI model. A typical application circuit can be found in the GS6080 datasheet.

3. Correlation

In this section, the GS6080 IBIS-AMI model is compared with some laboratory measurement results. Eye diagrams at the GS6080 output at HD, 3G, and 6G data rates are shown in Figure 3-1. The input pattern in these simulations was PRBS15.

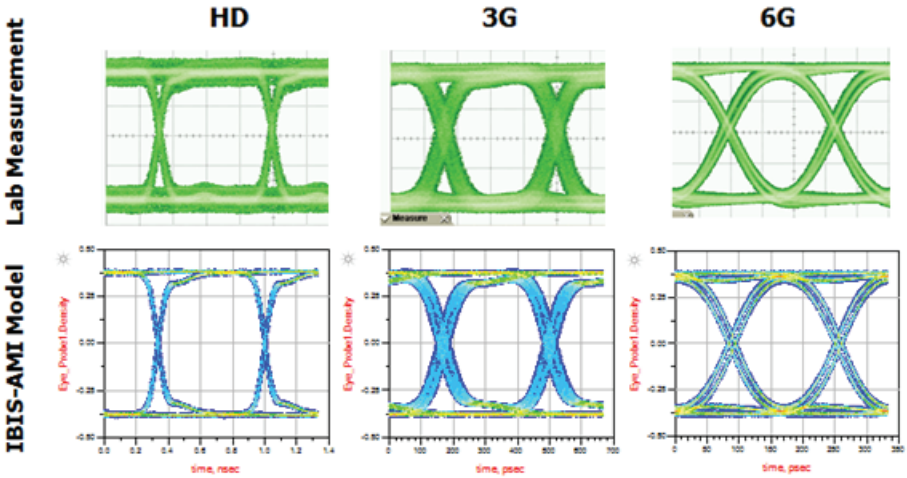

Figure 3-1: Eye Diagrams from Laboratory Measurements and Simulations Using the GS6080 IBIS-AMI Model at HD, 3G, and 6G Data Rates

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