



GS12070 IBIS-AMI Model

User Guide

Revision History

Version	ECO	PCN	Date	Changes and/or Modifications
1	040037	—	December 2017	Updated Table 1-2 .
0	036269	—	March 2017	New document.

Introduction

The GS12070 is highly-configurable UHD-SDI Gearbox which performs multiplexing and de-multiplexing necessary to facilitate conversions between SMPTE ST425-3 and/or ST 425-5 (multi-link 3G-SDI) Interface and SMPTE ST 2081-1 (6G UHD-SDI) and/or ST 2082-1 (12G UHD-SDI) Interfaces. The Gearbox also supports conversion between 4 x HD-SDI and 6Gb/s SDI.

This document describes the use of the IBIS-AMI models for the GS12070. The models facilitate simulation in EDA platforms compliant with the IBIS 5.0 standard.

1. GS12070 IBIS-AMI Models

The GS12070 IBIS models are provided for the high-speed serial inputs ($\overline{DDI}<n>/\overline{DDI}<n>$) and outputs ($\overline{DDO}<n>/\overline{DDO}<n>$).

1.1 GS12070 Input IBIS Model

The GS12070 input model consists of three parts:

1. Package model.
2. Input IBIS model.
3. Receiver AMI model.

The block diagram in [Figure 1-1](#) shows the sequence of signal flow and the individual parts of the model. The external S-parameter data for the package model increases the accuracy of the package effects compared to using discrete R, L, and C components as specified in the IBIS 5.0 standard. The external S-parameter data is processed as part of the channel by the EDA platform.

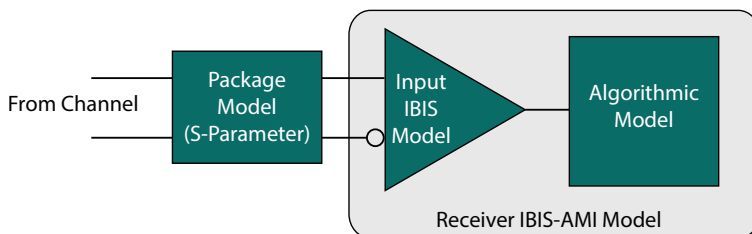


Figure 1-1: GS12070 Input Model

The input IBIS model contains the GS12070 device input termination circuitry, and is used by the EDA platform to determine the time-domain impulse response for the channel. The current revision of the input IBIS model contains typical (Typ), minimum (Min) and maximum (Max) corners. The desired supply corner can be selected from the EDA user interface.

The receiver AMI model includes the adaptive CTLE and DFE functionality of the GS12070. Note that the gearbox functionality is not included in the model. The CTLE and DFE functionality is controlled via AMI model-specific parameters. [Table 1-1](#) and [Table 1-2](#) identify the required settings for various simulation scenarios. Equivalent GS12070 CSRs are shown for parameters controllable in the GS12070 device.

Table 1-1: Rx CTLE and DFE Initialization Settings (Default Settings)

AMI Model Specific Parameter Setting	
rx_ctle_init_mode	2
rx_ctle_mode	0
rx_dfe_mode	14

Table 1-2: Rx CTLE Settings versus Channel Loss and Data Rate

Channel Loss at 6GHz (dB)	Data Rate = 12Gb/s		Data Rate ≤ 6Gb/s	
	AMI Model Specific Parameters rx_freq1, rx_freq2	GS12070 CSR Parameters (per lane) INPUT_EQ_x	AMI Model Specific Parameters rx_freq1,rx_freq2	GS12070 CSR Parameters (per lane) INPUT_EQ<n>
0 to < 4	0x01	0x3468		
4 to < 8	0x04	0x2C58	0x28	0x3468
8 to 12	0x08	0x2448		

The AMI model also includes a process corner parameter to select typical, fast and slow corners. Note that this corner setting is independent of the IBIS corner selected in the EDA tool. For correct simulation results the IBIS and AMI models should be set to use the same corner at all times (typical, fast/max, slow/min). [Table 1-3](#) shows the parameter values used to select AMI model corners.

Table 1-3: Rx AMI Corner Selection

Corner Condition	Power Supply Voltage	Temperature	AMI_corner_condition
Typical	Typical	Room	0
Fast	Maximum	Low	1
Slow	Minimum	High	-1

1.1.1 Receiver Mask Description

The GS12070 CDR function is not included in the AMI model. The output of the Rx model represents the output after the CTLE, AGC and DFE. In conjunction with the provided 1E-12 BER performance mask coordinates, this output can be used as a good indication of the available margin after the channel.

Mask Coordinates:

Vertical: $\pm 80\text{mV}$

Horizontal: $\pm 0.35\text{UI}$

1.2 GS12070 Output IBIS-AMI Model

The GS12070 output IBIS-AMI model consists of three parts:

1. Output IBIS model.
2. Output AMI model.
3. Package model.

The block diagram in [Figure 1-2](#) shows the sequence of signal flow and the individual parts of the model. The external S-parameter data for the package model increases the accuracy of the package effects compared to using discrete R, L, and C components as specified in the IBIS 5.0 standard. The external S-parameter data is processed as part of the channel by the EDA platform.

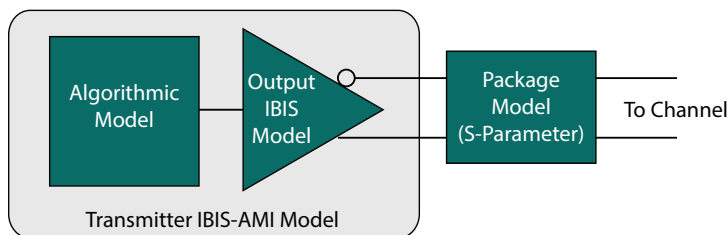


Figure 1-2: GS12070 Output Model

The current revision of the output IBIS model contains typical (Typ), minimum (Min) and maximum (Max) corners. The desired corner can be selected from the EDA user interface. The AMI model includes swing controls. [Table 1-4](#) lists the swing values corresponding to the AMI model settings and GS12070 CSR parameter values.

Table 1-4: GS12070 DDO AMI Model Swing Controls

Output Swing (mV _{ppd})	AMI Model Specific Parameters			GS12070 CSR Parameter
	tx_pre_cur	tx_main_cur	tx_post_cur	DDO<n>_AMP
400	0	23	4	0
500	0	29	5	1
600	0	35	6	2
700	0	41	7	3
800	0	47	8	4
900	0	51	7	5
1000	0	53	5	6

The tx_slew_rate_trim AMI parameter is not used in the GS12070. It should be set to 39 (the default value).

Jitter should be added to accurately model the transmitter in the EDA software. For 12G data Tx jitter should be added as specified below:

- ◆ **Deterministic Jitter** (Tx_Dj) 7ps
- ◆ **Random Jitter** (Tx_Rj) 1.0ps_{rms}

The AMI model also includes a process corner parameter to select typical, fast and slow corners. Note that this corner setting is independent of the IBIS corner selected in the EDA tool. For correct simulation results the IBIS and AMI models should be set to use the same corner at all times (typical, fast/max, slow/min). Table 1-5 shows the parameter values used to select AMI model corners.

Table 1-5: Tx AMI Corner Selection

Corner Condition	Power Supply Voltage	Temperature	AMI_corner_condition
Typical	Typical	Room	0
Fast	Maximum	Low	1
Slow	Minimum	High	-1

1.3 S-Parameter Package Models

Package models for the GS12070 are provided in standard touchstone format.

Table 1-6 lists the touchstone file port mappings between die pads and BGA package balls for the $DDI<n>/\overline{DDI}<n>$ pins. Table 1-7 lists the touchstone file port mappings between die pads and package balls for the $DDO<n>/\overline{DDO}<n>$ pins.

Note: During simulation, any unused ports should be terminated to 50Ω.

Table 1-6: $DDI<n>/\overline{DDI}<n>$ Touchstone Port Mapping

Signal	Package Ball Size	Die Pad Size
$\overline{DDI0}$	1	2
DDI0	3	4
$\overline{DDI1}$	5	6
DDI1	7	8

Table 1-7: $DDO<n>/\overline{DDO}<n>$ Touchstone Port Mapping

Signal	Package Ball Size	Die Pad Size
$\overline{DDO1}$	1	2
DDO1	3	4
$\overline{DDO0}$	5	6
DDO0	7	8

1.4 Supporting Files

Receiver IBIS-AMI Model

- sa6pma_rx.ibs
- sa6pma_rx.ami
- sa6pma_rx_x64.dll

Transmitter IBIS-AMI Model

- sa6pma_tx.ibs
- sa6pma_tx.ami
- sa6pma_tx_x64.dll

Package Models

- GS12070_Rx_Package_Model.s8p
- GS12070_Tx_Package_Model.s8p



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