**BUFFER ISSUE RESOLUTION DOCUMENT (BIRD)**

**BIRD NUMBER:** (for administrative use)

**ISSUE TITLE:** DUT\_ref\_term

**REQUESTOR:**  Walter Katz, Signal Integrity Software, Inc.

**DATE SUBMITTED:** (Draft 2, June 15, 2016)

**DATE REVISED:** (for administrative use)

**DATE ACCEPTED:** (for administrative use)

**DEFINITION OF THE ISSUE:**

All measurements (“IBIS Data”) that are used to generate voltage values for IBIS subparameters within the [Model], [Model Spec], [Submodel Spec], and [Receiver Thresholds] keywords and are relative to a test fixture reference node or a simulator reference node.

IBIS defines the derivation of “IBIS Data” consisting of I-V, V-T, ISSO and voltage thresholds for a device under test. For I-V, voltages are defined as measured across the associated [Pullup], [Pulldown], [POWER Clamp], and [GND Clamp] elements. For V-T, ISSO and voltage thresholds, IBIS defines the reference node used to measure these voltages. IBIS contemplates the use of these models with the buffer supplied by specific rail voltages prescribed by the [Voltage Range], [Pullup Reference], [Pulldown Reference], [POWER Clamp Reference], [GND Clamp Reference], and [External Reference] (“[\* Reference]”) keywords. These voltages are measured relative to the test fixture reference.

During a simulation that uses IBIS Models, the IBIS specification is not clear what node should be used as the reference node for these voltages. This is not an issue when the simulator supplies rail voltages (“\*\_ref”) to a model relative to the simulator reference node that are same as the reference voltages (“[\* Reference]”) supplied to the buffer when generating the IBIS Data. Some simulators use the terminal of the IBIS model that has a [\* Reference]=0.0V as the reference node for measurements. As a result, when a model is simulated with voltages applied to the models' rail terminals (relative to a simulator reference node) other than the prescribed values, it is not defined in the specification how to compare the voltages at the buffer I/O (pin) terminal with the thresholds that were generated relative to the test fixture reference.

**SOLUTION REQUIREMENTS:**

The IBIS specification must meet these requirements:

Table 1: Solution Requirements

|  |  |
| --- | --- |
| Requirement | Notes |
| 1. Allow an EDA tool to use IBIS model threshold in simulations where the voltages applied to a model rail terminals are not the same as the voltages applied to the rail terminals of the model when the “IBIS Data” is generated. |  |

(Enumerate each requirement in the table above, adding rows as needed.)

**SUMMARY OF PROPOSED CHANGES:**

This BIRD address this confusion by specifying the supply terminal whose voltage the EDA tool can use to adjust the voltage measurement at the model I/O terminal that can be compared with the model thresholds.

For review purposes, the proposed changes are summarized as follows:

Table 2: IBIS Keywords, Subparameters, AMI Reserved\_Parameters, and AMI functions Affected

|  |  |  |
| --- | --- | --- |
| Specification Item | New/Modified/Other | Notes |
| New [Model] subparameter DUT\_ref\_term | New |  |

**PROPOSED CHANGES:**

**Add to section 6.1 (along with other subparameter boilerplate sections of [Model]):**

*Required:* No

*Description:* This subparameter defines for this [Model] the rail terminal that should be used for measuring the voltage at all terminals of the model.

*Usage Rules:* The simulation node at the reference\_terminal should be used as the reference node of measurements at the pin\_name node and all rail nodes when comparing simulation results with model thresholds. The only allowed values of reference\_terminal are Pulldown\_ref, Gnd\_clamp\_ref, Pullup\_ref , Power\_clamp\_ref, and Ext\_ref.

*Other Notes:* The EDA tool should add the value of ([\* Reference]) to the voltage at all of the nodes measure referencing the DUT Reference Terminal**. The following table shows the [\* Reference] voltage that is applied to the corresponding terminal when the device is under test (DUT).**

[\* Reference] \*\_ref

[Pulldown Reference] Pulldown\_ref

[GND Clamp Reference] Gnd\_clamp\_ref

[Pullup Reference] Pullup\_ref

[POWER Clamp Reference] Power\_clamp\_ref

[External Reference] Ext\_ref

If a [Model] does not have a **[**DUT Reference Terminal**]** then:

If the model type is not ECL, the EDA Tool should use a rail terminal that has a [\* Reference] value that is 0.0V.

If the model type is ECL, then the EDA tool should use the terminal that has the maximum [\* Reference]

If a [Model] does not have a **[**DUT Reference Terminal**]** and there is no rail terminal that has a [\* Reference] value that is 0.0V, and the model type is not ECL, then the EDA tool should use the Pulldown\_ref terminal if it exists, otherwise the EDA tool should use the GND\_clamp\_ref terminal.

*Example:*

[Model] ECL\_0V

Model\_type I/O\_ECL

Vinh = -1.13V

Vinl = -1.48V

Vmeas = -1.29

Rref = 50.0

Cref = 0.0

Vref = -2.0

DUT\_ref\_term = Pullup\_ref

[Voltage Range] 0.0V 0.0V 0.0V

[GND Clamp Reference] -5.0V -5.0V -5.0V

|

[Model] DQ

Model\_type I/O

Vinh = 3.87V

Vinl = 3.52V

Vmeas = 3.71

Rref = 50.0

Cref = 0.0

Vref = 3.0

DUT\_ref\_term = Pullup\_ref

[Voltage Range] 5.0V 4.5V 5.5V

**BACKGROUND INFORMATION/HISTORY:**

Walter Katz gave a presentation “IO\_Buffer\_Reference\_Terminal” in the June 7, 2016 IBIS-ATM meeting, describing this issue.