**BUFFER ISSUE RESOLUTION DOCUMENT (BIRD)**

**BIRD NUMBER:** *xxx*

**ISSUE TITLE:** *AMI Reserved Parameters for Buffer Directionality*

**REQUESTOR:**  *Michael Mirmak, Intel Corp.*

**DATE SUBMITTED:** *(draft 1 to IBIS-AMI Task Group on Feburary 6, 2015)*

**DATE REVISED:**

**DATE ACCEPTED BY IBIS OPEN FORUM:**

**STATEMENT OF THE ISSUE:**

The 6.0 specification strongly implies that only input-only and output-only [Model]s may be associated with AMI data using the [Algorithmic Model] keyword pair. However, there is no explicit prohibition on using any model type with [Algorithmic Model] except Terminator, Series, and Series\_Switch.

The ibischk 6.01 parser correctly generates no errors if an [Algorithmic Model] keyword pair is associated with a model of Model\_type I/O. However, the association of an I/O buffer with either a Tx or Rx AMI file creates an ambiguous situation: the model, EDA tool, and user have no way currently to communicate, either in traditional IBIS or using AMI Reserved Parameters, the directionality state of the buffer at any one time.

**ANALYSIS PATH/DATA THAT LED TO SPECIFICATION:**

Two Reserved Parameters, AMI\_Model\_Type and AMI\_Model\_Direction, are proposed to define the model type and direction associated with a given Algorithmic Model. These are assumed to be consistent with the Model\_type defined for the associated analog [Model].

Ideally, a warning, caution, or note would be generated for buffers, with associated Algorithmic Models, of Model\_type I/O, 3-state, I/O\_open\_drain, I/O\_open\_sink, I/O\_open\_source, I/O\_ECL, or 3-state\_ECL, where these Reserved Parameters are not present.

**ANY OTHER BACKGROUND INFORMATION:**

The intent of these Reserved Parameters is ensure the EDA tool is “aware” of the associated models’ capabilities, to prevent cases where a channel is connected only to Rx endpoints with no Tx in the channel, or only to Tx endpoints with no receiving or 3-state device capable of receiving present or configured to do so.

This parameter set is assumed to be unaffected by the Polarity [Model] subparameter.

Thanks to Walter Katz of Signal Integrity Software (SiSoft) for his suggestions in an earlier verison of this proposal.

## Parameter DEFINITIONs

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*Parameter:* **AMI\_Model\_Type**

*Required:* No

*Descriptors*:

Usage: Info

Type: String

Format: Value

Default: <string\_literal>

Description:<string >

*Definition:* Tells the EDA tool whether the associated Algorithmic Model describes a transmitter (Tx), a receiver (Rx), or a configurable buffer capable of either transmission or reception (I/O). 3-state buffer declaration is also supported.

*Usage Rules:*

AMI\_Model\_Type accepts string literal values of “I/O”, “3-state”, “Tx” and “Rx”.

AMI\_Model\_Type is optional. If AMI\_Model\_Type is present with Value “I/O” or “3-state”, AMI\_Model\_Direction is required.

AMI\_Model\_Type is not permitted with all [Model] Model Types. EDA tools are assumed to check the [Model] Model\_Type of an analog buffer against the AMI\_Model\_Type of any associated [Algorithmic Model]. Table 1 below defines the [Model] Model\_Type circumstances in which AMI\_Model\_Type is permitted in the associated [Alogorithmic Model], the matching [Model] Model\_type, and where AMI\_Model\_Direction is required.

In the absence of AMI\_Model\_Type, the buffer inherits the Model\_Type of the associated [Model] keyword according to Table 1. Note that this does not eliminate potential ambiguities in model treatment during simulation.

The combination of AMI\_Model\_Type and AMI\_Model\_Direction permit a single AMI parameter file and DLL to be maintained for an I/O buffer that handles both Tx and Rx functions.

AMI\_Model\_Type and AMI\_Model\_Direction are not legal as Reserved\_Parameters in version 6.0 or earlier.

Table 1 – AMI\_Model\_Direction and [Model] Model\_Type Interaction

| **[Model] Model Type** | **AMI\_Model\_Type Permitted, with what Value(s)?** | **AMI\_Model\_Direction Required?** |
| --- | --- | --- |
| Input Input\_ECL  | Yes; Value shall be “Rx” | No; “Rx” is assumed |
| I/O I/O\_open\_drain I/O\_open\_sink I/O\_open\_source I/O\_ECL  | Yes; Value shall be “I/O” | Yes; only “Tx” and “Rx” permitted as List arguments |
| Terminator | No | N/A |
| OutputOutput\_ECL | Yes; Value shall be “Tx” | No; “Tx “ assumed |
| 3-state3-state\_ECL | Yes; Value shall be “3-state” | Yes; only “Tx” and “Ignore” permitted as List arguments |
| Open\_sink Open\_drainOpen\_source | Yes; Value shall be “Tx” | No; “Tx” is assumed |
| Series | No | N/A |
| Series\_switch | No | N/A |
| Input\_diff  | Yes; Value shall be “Rx” | No; “Rx” assumed |
| Output\_diff  | Yes; Value shall be “Tx” | No; “Tx” is assumed |
| I/O\_diff  | Yes; Value shall be “I/O” | Yes; only “Tx” and “Rx” permitted as List arguments |
| 3-state\_diff | Yes; Value shall be “3-state” | Yes; only “Tx” and “Ignore” permitted as List arguments |

*Other Notes:* This parameter prevents association of an Algorithmic Model with an incompatible analog model. AMI\_Model\_Type is assumed defined and fixed by the model author.

*Examples:*

(AMI\_Model\_Type (Usage Info) (Type String) (Value “I/O”)

 (Description “Valid values are 3-state, I/O, Tx, and Rx”)

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*Parameter:* **AMI\_Model\_Direction**

*Required:* Yes, if AMI\_Model\_Type uses Value “3-state” or “I/O”

*Descriptors*:

Usage: In, Info

Type: String

Format: List

Default: <string\_literal>

Description:<string >

*Definition:* Tells the model the direction (state) of a 3-state or I/O [Algorithmic Model] to use in a given simulation.

*Usage Rules:*

AMI\_Model\_Direction required where AMI\_Model\_Type for the same [Algorithmic Model] is declared with Value “I/O” or “3-state”. In this case, the simulation tool must know the specific state of the buffer for that simulation. AMI\_Model\_Direction may be used for other AMI\_Model\_Type assignments, but is optional in those cases. AMI\_Model\_Direction is prohibited for an Algorithmic Model where AMI\_Model\_Type is not present.

AMI\_Model\_Direction accepts string literal values of “Ignore”, “Tx” or “Rx” in a List Format. The List values available for any given instance shall not be greater than two. Valid Values of AMI\_Model\_Direction for AMI\_Model\_Type assignments of “I/O” are “Tx” and “Rx”. Valid Values of AMI\_Model\_Direction for AMI\_Model\_Type assignments of “3-state” are “Tx” and “Ignore”. The available List values for AMI\_Model\_Direction in a model for any given AMI\_Model\_Type are listed in Table 1.

Changing of AMI\_Model\_Direction during a simulation is not permitted.

AMI\_Model\_Direction is assumed to be configurable between the available options at simulation time by the user through the EDA tool. The combination of AMI\_Model\_Type and AMI\_Model\_Direction permit a single AMI parameter file and DLL to be maintained for an I/O buffer that handles both Tx and Rx functions.

AMI\_Model\_Type and AMI\_Model\_Direction are not legal as Reserved\_Parameters in version 6.0 or earlier.

*Other Notes:* This parameter prevents association of an Algorithmic Model with an incompatible analog model.

*Examples:*

(AMI\_Model\_Direction (Usage In) (Type String) (List “Tx” “Rx”)

 (Description “Valid values are Ignore, Tx, and Rx”)