**BUFFER ISSUE RESOLUTION DOCUMENT (BIRD)**

**BIRD NUMBER:** 161.1

**ISSUE TITLE:** Supporting Incomplete and Buffer-only [Component] Descriptions

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

**DATE SUBMITTED:** May 8, 2013

**DATE REVISED:** May 10, 2013

**DATE ACCEPTED BY IBIS OPEN FORUM:** Rejected October 27, 2017

**STATEMENT OF THE ISSUE:**

Due to the limited technical capabilities of existing IBIS package modeling structures, IBIS files are often used as buffer-only descriptions by the industry. These buffer-only descriptions typically set the package parasitics entries under [Package] and/or [Pin] to zero. Further, IBIS files are often created and distributed that only contain a partial listing of available buffers and pins, rather than a complete list of all the buffers and associated pins (or pads) for a given device.

However, because the [Package] keyword is required, there is no way to distinguish an IBIS [Component] which is intended to describe only buffers from an IBIS [Component] generated in an early stage of component development, for which package information simply is not yet available. Both [Component]s would have zero-valued [Package] entries. Similarly, there is no way to automatically distinguish a complete IBIS [Component] description of a device from a partial one.

Two new subparameters for [Component] – Scope and Pin\_reference – are defined, to specify whether the [Component] is intended to be a whole or partial component description, and whether the [Pin] keyword refers to pins or buffer pads. As these subparameters are relatively minor in terms of their impact on any given IBIS file, retrofitting of existing IBIS files is easy.

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

**ANY OTHER BACKGROUND INFORMATION:**

Changes to the keyword and subparameter hierarchy tree are not shown here.

The contents of [Node Declarations] may be different if Pin\_reference is set to “Pad” vs. “Pin”. However, if internal die nodes are present, the need for [Node Declarations] is not removed if Pin\_reference is set to “Pad”.

Note that an alternative to the Pin\_reference subparameter is a new keyword such as [Pads] or [Die Pads] as proposed by Walter Katz. Such a keyword would be highly similar to the [Pin] keyword in structure. However, the number of changes to keywords and subparameters needed to support such a keyword would considerably complicate the specification.

Separately, during development of this specification change, it was discovered that [Test Load] and [Test Data] do not clearly state whether they apply only to package-less situations or whether package information can or should be included when they are used. This may interact with interpretations of Pin\_reference.

While setting Pin\_reference to “Pad” ensures that package information is not included, Arpad Muranyi has pointed out that the treatment of on-die interconnect information is ambiguous here. If Pin\_reference is set to “Pad”, then the list under [Pin] is assumed to refer to access points for single buffers. The resulting IBIS [Component] becomes buffer-only and both package and on-die interconnect can be described outside of the IBIS [Component]. The mapping between the buffer node access points, the actual die pads, the on-die interconnect, the actual device pins and the package interconnect would be handled outside the IBIS [Component].

BIRD 161.1 is issued to address two problems with the [Pin] keyword. First, the usage rules for [Pin] explicitly require that all the pins on a component be included. This conflicts with “Scope” and is also beyond the capacity of a parser to check using the IBIS file data alone. Second, there is no explicit rule under [Pin] that prohibits duplicate entries in the first column – the pin identifier itself. Yet the IBISCHK5 parser will flag duplicate entries as errors. As [Pin] is used to define unique instances of [Model]s, an explicit rule regarding duplicate pins is consistent with industry practice.

*Keyword:* **[Component]**

*Required:* Yes

*Description:* Marks the beginning of the IBIS description of the integrated circuit named after the keyword.

*Sub-Params:* Si\_location, Timing\_location, Scope, Pin\_reference

*Usage Rules:* If the .ibs file contains data for more than one component, each section must begin with a new [Component] keyword. The length of the component name must not exceed 40 characters, and blank characters are allowed.

NOTE: Blank characters are not recommended due to usability issues.

Si\_location and Timing\_location are optional and specify where the Signal Integrity and Timing measurements are made for the component. Allowed values for either subparameter are “Die” or “Pin”. The default location is at the “Pin”.

Scope is optional and specifies whether the [Component] description (including the [Pin] list) is complete and for an actual manufactured device, or whether the [Component] description is partial. An example of a partial [Component] description would be where only one [Model] and one associated pin are present in the [Pin] list, because the [Component] is used to describe only the behavior of a individual signal and not the behavior of an entire device. Allowed values for the Scope subparameter are “Complete” and “Partial”. The default value is “Complete.”

Pin\_reference is optional and specifies whether the [Component] (including the [Pin] list) is intended to describe a packaged device, or whether the [Component] is only intended to present the buffer behavior of the device. If the [Component] description is buffer-only, then the [Pin] keyword actually lists buffer pads or buffer nodes. Any [Package] information is meaningless. Allowed values for the Pin\_reference subparameter are “Pin” and “Pad”. The default value is “Pin”.

When Pin\_reference is set to “Pad”, Si\_location and Timing\_location are ignored.

*Other Notes:* If the value of Pin\_reference is “Pad”, then the EDA tool shall ignore the [Package], [Package Model], [Alternate Package Models], and [End Alternate Package Models] keywords, in addition to any R\_pin, L\_pin, and C\_pin entries under the [Pin] keyword. Further, if the value of Pin\_reference is “Pad”, any keywords referring to “pin” shall be interpreted to refer to the corresponding die pad instead. This includes [Pin], [Pin Mapping], [Series Pin Mapping], [Diff Pin], [Pin EMI], and [Pin Domain EMI].

*Examples:*

[Component] 7403398 MC452

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Si\_location Pin | Optional subparameters to give measurement

Timing\_location Die | location positions

[Component] Prototype\_MCU

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Scope Partial | [Component] and [Pin] list do not describe an

| entire device

Pin\_reference Pad | [Pin] refers to die pads

Changes to the [Pin] keyword are noted in the text below.

Keyword: [Pin]

*Required:* Yes

*Description:* Associates the component’s I/O models to its various external pin names and signal names.

*Sub-Params:* signal\_name, model\_name, R\_pin, L\_pin, C\_pin

*Usage Rules:* ~~All pins on a component must be specified.~~ The first column must contain the pin name. The second column, signal\_name, gives the data book name for the signal on that pin. The third column, model\_name, maps a pin to a specific I/O buffer model or model selector name. Each model\_name must have a corresponding model or model selector name listed in a [Model] or [Model Selector] keyword below, unless it is a reserved model name (POWER, GND, or NC).

Each line under the [Pin] keyword for a given [Component] shall contain a unique entry in the first column. Entries in the model\_name and signal\_name columns may appear in multiple lines.

The model\_name column cannot be used for model or model selector names that reference Series and Series\_switch models.

Each line must contain either three or six columns. A pin line with three columns only associates the pin’s signal and model. Six columns can be used to override the default package values (specified under [Package]) FOR THAT PIN ONLY. When using six columns, the headers R\_pin, L\_pin, and C\_pin must be listed. If “NA” is in columns 4 through 6, the default packaging values must be used. The headers R\_pin, L\_pin, and C\_pin may be listed in any order.

Column length limits are:

[Pin] 5 characters max

model\_name 40 characters max

signal\_name 40 characters max

R\_pin 9 characters max

L\_pin 9 characters max

C\_pin 9 characters max

*Example:*

[Pin] signal\_name model\_name R\_pin L\_pin C\_pin

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 1 RAS0# Buffer1 200.0m 5.0nH 2.0pF

 2 RAS1# Buffer2 209.0m NA 2.5pF

 3 EN1# Input1 NA 6.3nH NA

 4 A0 3-state

 5 D0 I/O1

 6 RD# Input2 310.0m 3.0nH 2.0pF

 7 WR# Input2

 8 A1 I/O2

 9 D1 I/O2

 10 GND GND 297.0m 6.7nH 3.4pF

 11 RDY# Input2

 12 GND GND 270.0m 5.3nH 4.0pF

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 18 Vcc3 POWER

 19 NC NC

 20 Vcc5 POWER 226.0m NA 1.0pF

 21 BAD1 Series\_switch1 | Illegal assignment

 22 BAD2 Series\_selector1 | Illegal assignment

9 D1 I/O2

10 GND GND 297.0m 6.7nH 3.4pF

11 RDY# Input2

12 GND GND 270.0m 5.3nH 4.0pF

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18 Vcc3 POWER

19 NC NC

20 Vcc5 POWER 226.0m NA 1.0pF

21 BAD1 Series\_switch1 | Illegal assignment

22 BAD2 Series\_selector1 | Illegal assignment