**BUFFER ISSUE RESOLUTION DOCUMENT (BIRD)**

**BIRD NUMBER:** 182

**ISSUE TITLE:** POWER and GND [Pin] signal\_name as [Pin Mapping] bus\_label

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

**DATE SUBMITTED:** August 30, 2016

**DATE REVISED:**

**DATE ACCEPTED:** October 14, 2016

**DEFINITION OF THE ISSUE:**

The [Pin Mapping] keyword currently allows confusing situations where one bus label can have rails pins on different signal names, and different model names. Also, this BIRD allows the default bus label on every POWER and GND pin to be the signal name on that pin. This BIRD also relieves the requirement to have a [Pin Mapping] record for NC pins.

**SOLUTION REQUIREMENTS:**

The IBIS specification must meet these requirements:

|  |  |
| --- | --- |
| Requirement | Notes |
| 1. Do not require that POWER, GND or NC pins have entries in the [Pin Mapping] section. The bus label on a POWER or GND pin that is not under the [Pin Mapping] keyword shall be the signal name of the POWER or GND pin.
 |  |
| 1. Require that if two POWER or GND pins have the same bus label, that they have the same signal name.
 |  |

**SUMMARY OF PROPOSED CHANGES:**

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

|  |  |  |
| --- | --- | --- |
| Specification Item | New/Modified/Other | Notes |
| [Pin Mapping] | Modified |  |

**PROPOSED CHANGES:**

**Replace the following section:**

*Keyword:* [Pin Mapping]

*Required:* No

*Description:* Used to indicate the power and/or ground buses to which a given driver, receiver or terminator is connected.

*Sub-Params:* pulldown\_ref, pullup\_ref, gnd\_clamp\_ref, power\_clamp\_ref, ext\_ref

*Usage Rules:* The [Pin Mapping] keyword names the connections between POWER and/or GND pins and buffer and/or terminator voltage supply references using unique bus labels. All buses with identical labels are assumed to be connected with an ideal short. Each label must be associated with at least one pin whose model\_name is POWER or GND. Bus labels must not exceed 15 characters.

Each line must contain either three, five or six entries. Use the reserved word NC where an entry is required but a bus connection is not made.

The first column contains a pin name. Each pin name must match one of the pin names declared in the [Pin] section of the [Component].

For buffers and terminators, the remaining columns correspond to the voltage supply references for the named pin. Each [Model] supply reference is connected to a particular bus through a bus label in the corresponding column.

The second column, pulldown\_ref, designates the ground bus connections for the buffer or termination associated with that pin. The bus named under pulldown\_ref is associated with the [Pulldown] I-V table for non-ECL [Model]s. This is also the bus associated with the [GND Clamp] I-V table and the [Rgnd] model unless overridden by a label in the gnd\_clamp\_ref column.

The third column, pullup\_ref, designates the power bus connection for the buffer or termination. The bus named under pullup\_ref is associated with the [Pullup] table for non-ECL [Model]s (for ECL models, this bus is associated with the [Pulldown] table). This is also the bus label associated with the [POWER Clamp] I-V table and the [Rpower] model unless overridden by a label in the power\_clamp\_ref column.

The fourth and fifth columns, gnd\_clamp\_ref and power\_clamp\_ref, contain entries, if needed, to specify additional ground bus and power bus connections for clamps. Finally, the sixth column, ext\_ref, contains entries to specify external reference supply bus connections.

The usage of the columns changes for GND and POWER pins. For GND pins, the pulldown\_ref column contains the name of the bus to which the pin connects; the pullup\_ref column in this case must contain the reserved word NC. Similarly, for POWER (including external reference) pins, the pullup\_ref column contains the name of the bus to which the pin connects; the pulldown\_ref column in this case must contain the reserved word NC.

If the [Pin Mapping] keyword is present, then the bus connections for EVERY pin listed under the [Pin] keyword must be given.

If a pin has no connection, then both the pulldown\_ref and pullup\_ref subparameters for it will be NC.

The column length limits are:

[Pin Mapping] 5 characters max

pulldown\_ref 15 characters max

pullup\_ref 15 characters max

gnd\_clamp\_ref 15 characters max

power\_clamp\_ref 15 characters max

ext\_ref 15 characters max

For compatibility with models developed under previous IBIS versions, [Pin Mapping] lines which contain ext\_ref column entries must also explicitly include entries for the pulldown\_ref, pullup\_ref, gnd\_clamp\_ref and power\_clamp\_ref columns. These entries can be NC.

When six columns of data are specified, the headings gnd\_clamp\_ref, power\_clamp\_ref and ext\_ref must be used on the line containing the [Pin Mapping] keyword. Otherwise, these headings can be omitted.

**With (Changed lines are underlined and in red)**

*Keyword:* [Pin Mapping]

*Required:* No

*Description:* Used to indicate the power and/or ground buses to which a given driver, receiver or terminator is connected.

*Sub-Params:* pulldown\_ref, pullup\_ref, gnd\_clamp\_ref, power\_clamp\_ref, ext\_ref

*Usage Rules:* The [Pin Mapping] keyword names the connections between POWER and/or GND pins and buffer and/or terminator voltage supply references using unique bus labels. All buses with identical labels are assumed to be connected with an ideal short. Each label must be associated with at least one pin whose model\_name is POWER or GND. If a bus label is associated with more than one pin whose model\_name is POWER or GND, then all of these associated pins must have the same signal\_name. Bus labels must not exceed 15 characters.

Each line must contain either three, five or six entries. Use the reserved word NC where an entry is required but a bus connection is not made.

The first column contains a pin name. Each pin name must match one of the pin names declared in the [Pin] section of the [Component].

For buffers and terminators, the remaining columns correspond to the voltage supply references for the named pin. Each [Model] supply reference is connected to a particular bus through a bus label in the corresponding column.

The second column, pulldown\_ref, designates the ground bus connections for the buffer or termination associated with that pin. The bus named under pulldown\_ref is associated with the [Pulldown] I-V table for non-ECL [Model]s. This is also the bus associated with the [GND Clamp] I-V table and the [Rgnd] model unless overridden by a label in the gnd\_clamp\_ref column.

The third column, pullup\_ref, designates the power bus connection for the buffer or termination. The bus named under pullup\_ref is associated with the [Pullup] table for non-ECL [Model]s (for ECL models, this bus is associated with the [Pulldown] table). This is also the bus label associated with the [POWER Clamp] I-V table and the [Rpower] model unless overridden by a label in the power\_clamp\_ref column.

The fourth and fifth columns, gnd\_clamp\_ref and power\_clamp\_ref, contain entries, if needed, to specify additional ground bus and power bus connections for clamps. Finally, the sixth column, ext\_ref, contains entries to specify external reference supply bus connections.

The usage of the columns changes for GND and POWER pins. For GND pins, the pulldown\_ref column contains the name of the bus to which the pin connects; the pullup\_ref column in this case must contain the reserved word NC. Similarly, for POWER (including external reference) pins, the pullup\_ref column contains the name of the bus to which the pin connects; the pulldown\_ref column in this case must contain the reserved word NC.

If the [Pin Mapping] keyword is present, then the bus connections for EVERY pin listed under the [Pin] keyword whose model name is not POWER, GND or NC must be given. If a pin has model name POWER or GND and there is no entry for this pin in the Pin Mapping section then the bus\_label for that pin will be its signal name.

If a pin has no connection, then both the pulldown\_ref and pullup\_ref subparameters for it will be NC.

The column length limits are:

[Pin Mapping] 5 characters max

pulldown\_ref 15 characters max

pullup\_ref 15 characters max

gnd\_clamp\_ref 15 characters max

power\_clamp\_ref 15 characters max

ext\_ref 15 characters max

For compatibility with models developed under previous IBIS versions, [Pin Mapping] lines which contain ext\_ref column entries must also explicitly include entries for the pulldown\_ref, pullup\_ref, gnd\_clamp\_ref and power\_clamp\_ref columns. These entries can be NC.

When six columns of data are specified, the headings gnd\_clamp\_ref, power\_clamp\_ref and ext\_ref must be used on the line containing the [Pin Mapping] keyword. Otherwise, these headings can be omitted.

**BACKGROUND INFORMATION/HISTORY:**

These changes eliminate confusion in the existing specification when pins of two different signal names can be shorted together. This BIRD also recognizes that the common practice that bus labels on POWER and GND pins have been consistently set equal to their signal names. A presentation was given to the IBIS Open Forum (<http://www.ibis.org/interconnect_wip/PinMapping.pdf>) on October 1, 2014 which describes the problem and how to fix it.