

IBIS Interconnect Task Group

# IBIS Interconnect Task Group Update: Touchstone 3.0 Features & Progress

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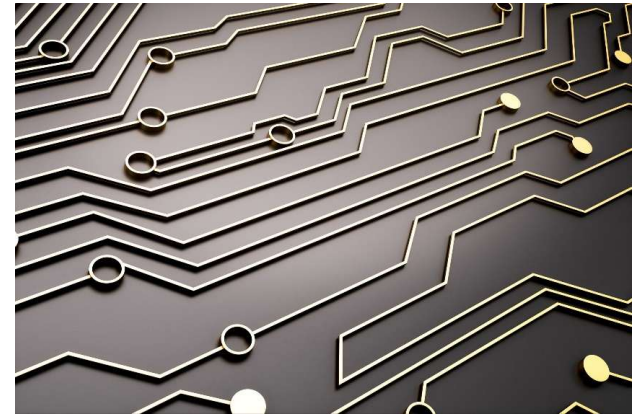
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# Who Is The IBIS Interconnect Task Group?

- Designs and writes technical changes to support passive interconnect modeling formats
  - Supports IBIS, Touchstone and IBIS-ISS
  - Live teleconferences are held Wednesdays 8-9 AM US Pacific Time
  - Web site: [https://ibis.org/interconnect\\_wip/](https://ibis.org/interconnect_wip/)
  - Freelists is the most up-to-date source for documents and discussion:  
<https://freelists.org/archive/ibis-interconn/>



# Interconnect Task Group Current Work

- Touchstone 3.0 is being prepared
- Touchstone Issue Resolution Documents
  - 7.2 [Standardized Pole-Residue Representation](#)
  - 8 [Option line changes](#)
  - (9) Port-mapping (WIP): [Draft 19](#)



The goal: balance usability by the wider industry (e.g., for RF and circuit purposes) with IBIS-specific features to help with package and system interconnect modeling

# Pole-Residue for File Compression

Not shown...  
 [Begin Pole-Residue Data Source]/  
 [End Pole-Residue Data Source]

- A coefficients example, where data corresponds to  $[\alpha_m \omega_m A_m B_m]$  complex pole and normalized residue pairs, respectively

```
[Number of Pole-Residue Indices] 10

[Begin Pole-Residue Data] (1,1) (2,2) (3,3) (4,4)
Delay = 1.26351e-09
Constant_at_infinity = 0.321123423421
Number_of_data_lines = 35
1.60981891e+08 6.038300e+09 -2.15363238e-06 1.96534688e-05
2.93321810e+09 1.917708e+09 -1.05426912e+01 -8.82630433e+00
1.23990373e+08 4.399943e+09 1.257286128e-05 2.13669372e-05
...
5.23409852e+06 1.345345e+07 3.073147044e-06 5.16091015e-06
[End Pole-Residue Data]

| Additional data pairs follow...
```

Alternately, a pair of keywords may be used:

## Common Poles Data

- All matrix elements share the same poles
- Just one per set model file

## Residues Data

- Defines data for individual pairs
- Also includes the same subparameters

The data is meant for use in a single equation shown here for one (row, column) element...

$$H(if) = e^{-i2\pi fD} \left\{ H_0 + \frac{1}{2} \sum_{m=1}^M \left[ \frac{A_m - iB_m}{1 + if / (\alpha_m + i\omega_m)} + \frac{A_m + iB_m}{1 + if / (\alpha_m - i\omega_m)} \right] \right\} + ifG$$

This format is understood and used, with variations, by several existing industry tools.

This change to Touchstone has already been approved.

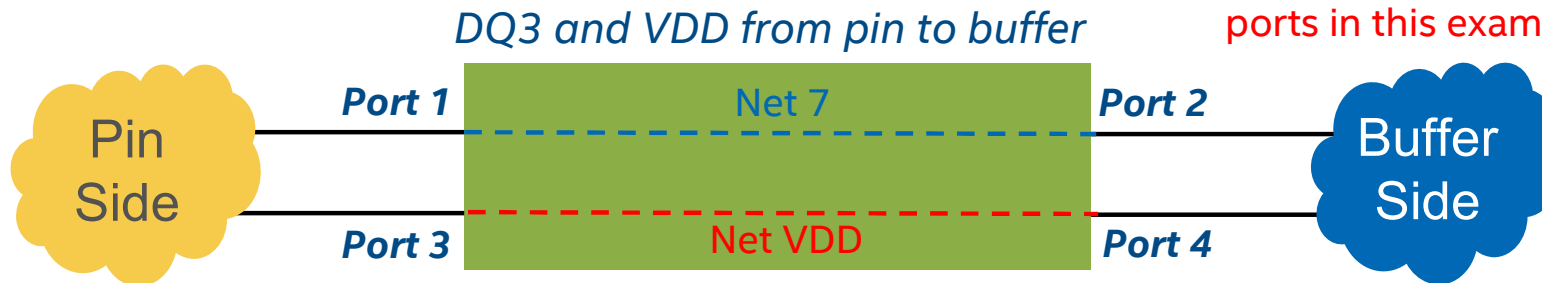
# Port-Mapping for Clarity in Usage (WIP)

```
[Begin Port Map]
|
Data_usage "IBIS_Interconnect"
Port 1 (Physical pin.7)           (Type S) (Side Pin)   (Net 7) (Logical DQ3pin)
Port 2 (Physical buf.7)          (Type S) (Side Buffer) (Net 7) (Logical DQ3buffer)
Port 3 (Physical Pin.Bus_label:VDD) (Type P) (Side Pin)   (Net VDD) (Logical VDDpin)
Port 4 (Physical Pullup_ref.7)    (Type P) (Side Buffer) (Net VDD) (Logical VDDbuffer)
Symbol_leftside 1 3
Symbol_rightside 2 4
|
[End Port Map]
```

Data\_usage is optional, and supports IBIS structures EMD, C\_comp\_model and Ts4file as well

Net, Reference, and Diff\_Port identifiers are also available

A port is a pair of terminals. The reference terminal is A\_gnd for all ports in this example.

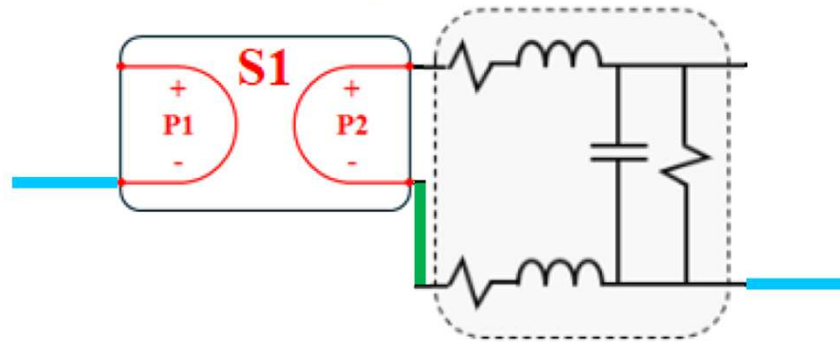


Physical and Net provide connectivity guidance;  
All other identifiers are informative (e.g., for schematic symbols)

# A Significant Port-Mapping Challenge

- Referencing can depend on context
  - “Ground is for potatoes and carrots” – Bruce Archambault
- SI interest in Touchstone today is in large part for circuit analysis
  - Correct reference node definitions are vital to proper voltage, current probing in circuit simulation
- ... but Touchstone began in RF, where wave behaviors and referencing operate differently
- The current loops of the whole system must be understood
  - A given loop can be represented in several equivalent ways

Should the *blue* and *green* nodes be considered connected? Are they all references? Are they all “ground”?



Take care to understand tool behavior and data collection assumptions when connecting Touchstone data to circuits

# Our Request to the Community

- Several IBIS Summit audiences plus individual industry comments have been consistent:
  - Reduce file sizes & support port-mapping for automation in Touchstone
- If these two features were the only major changes to Touchstone...
  - ... would you switch from Touchstone 1.x to Touchstone 3.0 as default?
- What test cases would you need to evaluate Touchstone 3.0?



Please review the drafts and provide comments!

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