

IBIS Interconnect Task Group

IBIS Interconnect Task Group Update: Touchstone 3.0 Features & Progress

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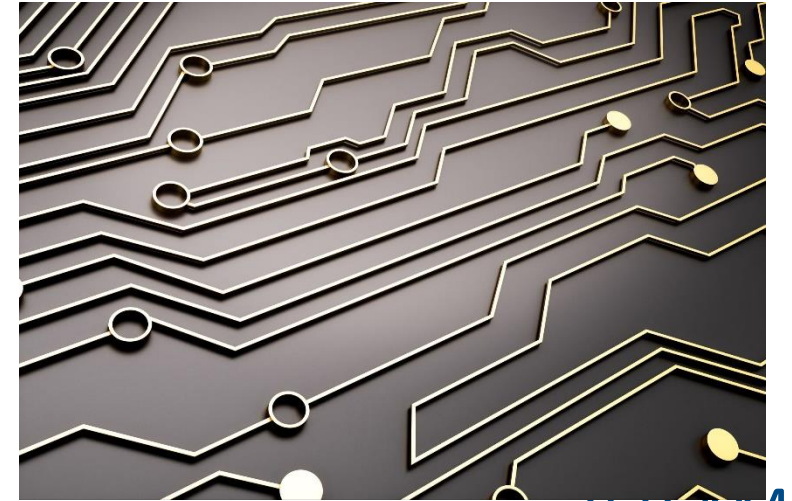
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Who Is The IBIS Interconnect Task Group?

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



8-9 AM

Interconnect Task Group Current Work

- Touchstone 3.0 is being prepared
- **T**ouch**s**tone **I**ssue **R**esolution **D**ocuments
 - 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.

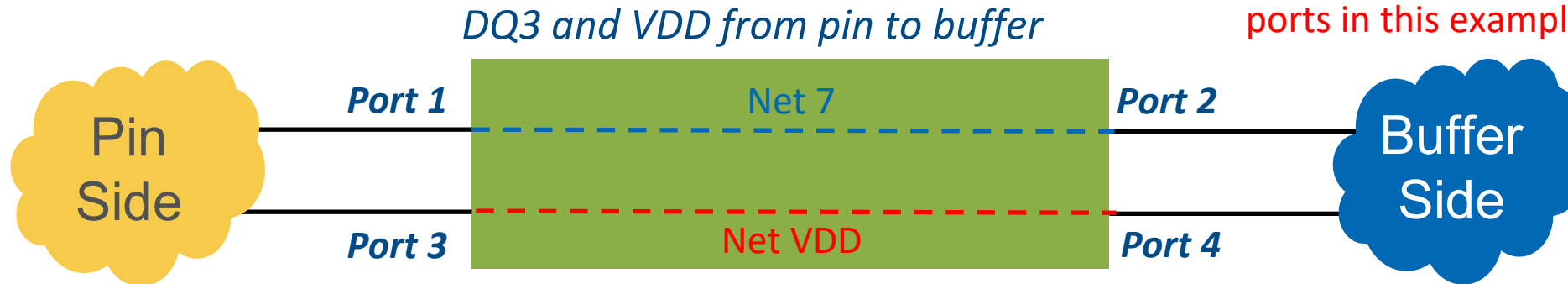
Port-Mapping for Clarity in Usage (WIP)

```
[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.

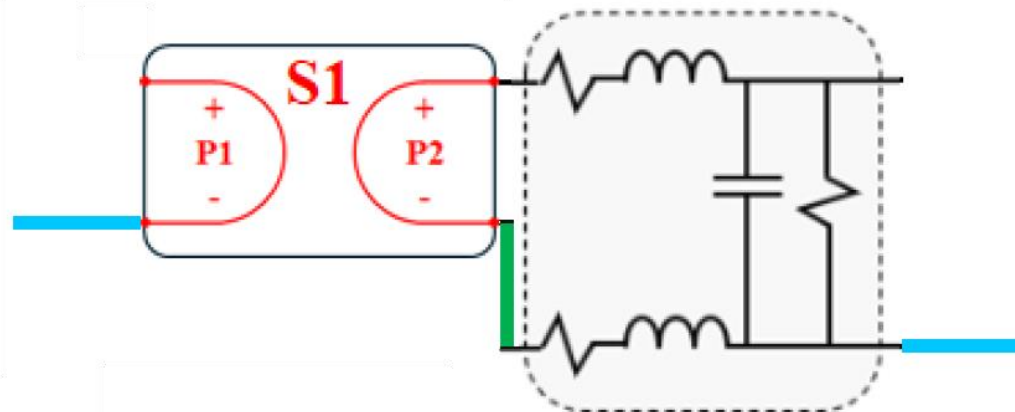


Physical and Net provide connectivity guidance;
All other identifiers are informative (e.g., for schematic symbols)

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 comments have been consistent:
 - Reduce file sizes & support port-mapping for 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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