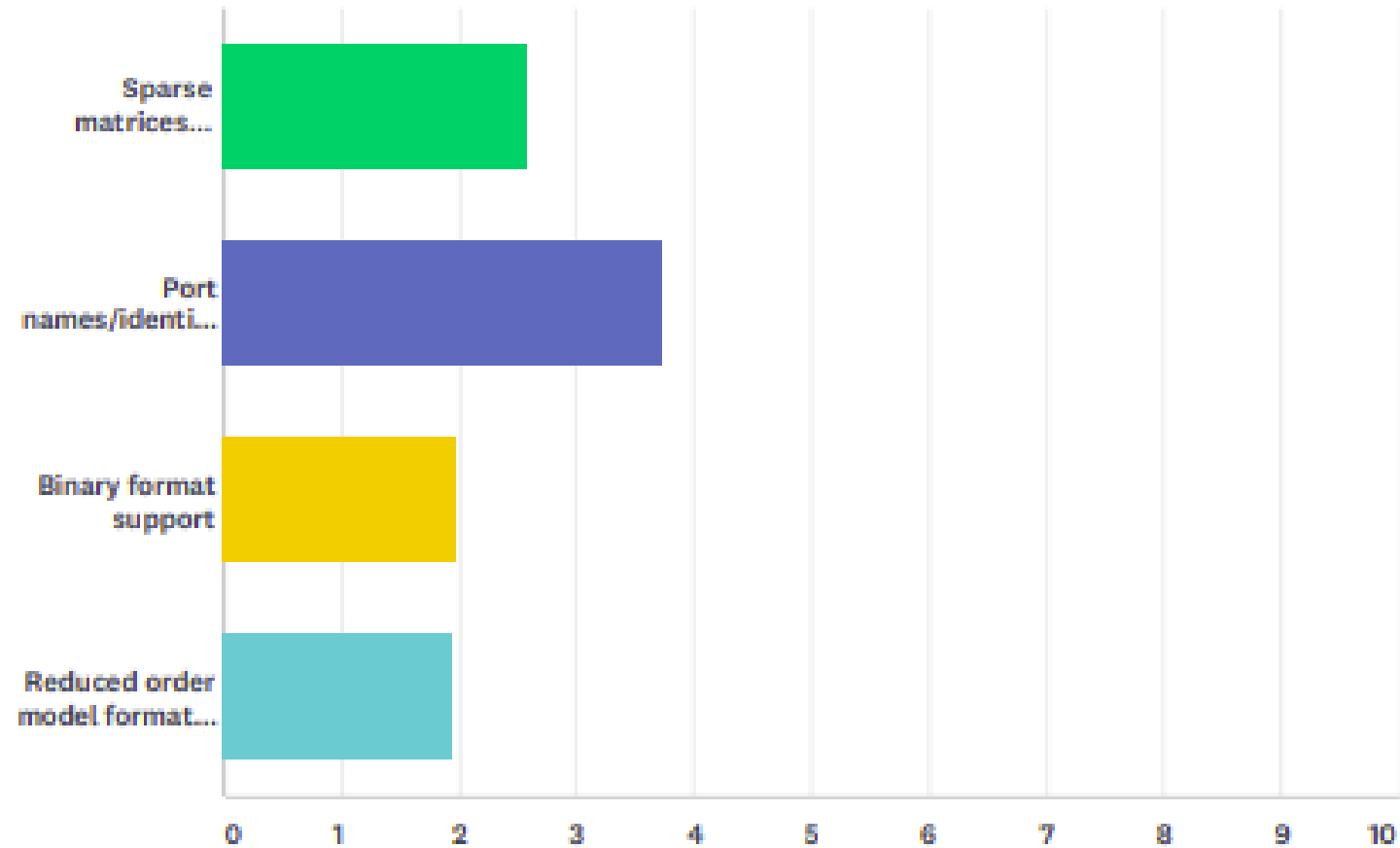


# Port Naming Enhancement for Touchstone Files

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# 2019 IBIS Touchstone Survey

[2019 IBIS Touchstone Survey Report.pdf](#)



# Typical Documentation in S-Parameter Files Today

## How Would You Hook Up this S-Parameter in your Schematic?

```
# hz S ma R 50
! 4 Port Network Data from SP1.SP block
! freq magS11 angS11 magS12 angS12 magS13 angS13 magS14 angS14
!      magS21 angS21 magS22 angS22 magS23 angS23 magS24 angS24
!      magS31 angS31 magS32 angS32 magS33 angS33 magS34 angS34
!      magS41 angS41 magS42 angS42 magS43 angS43 magS44 angS44
!
0      0.007 9.88e-013 0.979 1.19e-014 0.0103 6.34e-013 0.0005 8.40e-012
...
```

## What is Desired?

- Computer parsable and human readable records in the beginning of a Touchstone file that can be used by users and EDA tools to help insure proper usage of the Touchstone file.
- These enhancements are focused on Touchstone files used to describe interconnect.

# In the Absence of a Standard, EDA Tools, Users of Touchstone Files and Standards Groups use Proprietary Formats

For example,

IEEE Std 370-2020 defines the following records that associates a name to each port (e.g., “Pin 04”), and the near end (end a) and far end (end b).

```
!* BASE BOARD (end a) ->>- (end b) LOAD CARD *
```

```
!* -----
```

```
!* Port 01 (Pin 04) ->>- (Pin 04) Port 03
```

```
!* Port 02 (Pin 05) ->>- (Pin 05) Port 04
```

# Requirements

- What is required for each port
  - One Name
    - Either a logical (e.g., DDR0\_DQ1) or physical name (e.g., U7.27)
  - An End
    - Near/Far
    - SideA/SideB
    - Chip ID for multi-drop connections
  - Connections
    - Which ports are “through” connections with low insertion loss
- What is not required for each port, but nice to have optionally
  - Differential port
- Would the following information be useful
  - Both physical and logical names
  - Chord ports, 3 or more wires ([What is Chord Signaling? | Keysight Blogs](#))
  - Reference information

# Port Reference Terminal Information

- IEEE Std 370-2020 S

Ports are numbered from 1 to N. **Each port has two terminals. One terminal is the signal and another terminal is local reference or local ground terminal.** Current flowing in the signal terminal is equal to current flowing out of the reference terminal at each port. Connection of multiports requires that the definition of the terminals on both sides of the connection is the same. It means that the local references can be different for different ports of a multiport, but they have to coincide with the local reference terminals of another multiport to be connected. Some groups of ports may share the reference terminals. The currents and voltages at ports are either actual measurable values or effective voltages and currents as in microwave theory. In the frequency domain, the currents and voltages are complex variables and can be united into vectors with N complex elements:

- IBIS 7.1 assumes a single reference node for all ports of a Touchstone file.
  - This reference node can be “Node 0”
- Should we optionally add a name, location and ground net name of the port reference terminal used to make the Touchstone measurements?

# IBIS Interconnect is Currently Working on a Touchstone Enhancement for Port Information

- Information on each Port
  - Logical Name (Controller\_DQ1)
  - Physical Name (U17.3)
  - “End” (Chip)
    - Can be two ends (near and far end)
      - This is the most common form of Touchstone data
    - Multi-drop connections (e.g., Memory Address/Command) can have multiple “Ends”
  - Connected Ports
  - Differential Ports
  - Reference Ports



# Example Format Currently Being Discussed

[Begin Port Data] ! This example is two coupled differential pairs between Side A and Side B of a connector

! Port	Log-name	Phy-name	end	net	differential
1	Tx0_T	Ja.1	A	0	3
2	Rx0_T	Jb.1	B	0	4
3	Tx0_C	Ja.2	A	1	1
4	Rx0_C	Jb.2	B	1	2
5	Tx1_T	Ja.3	A	2	7
6	Rx1_T	Jb.3	B	2	8
7	Tx1_C	Ja.4	A	3	5
8	Rx1_C	Jb.4	B	3	6

[End Port Data]

[Begin Port Data] ! This example is two DQ connections from a controller to two memories

! Port	Log-name	Phy-name	end	net	differential
1	C_DQ0	U1.7	C	DQ0	
2	M0_DQ0	U2.2	M0	DQ0	
3	M1_DQ0	U3.2	M1	DQ0	
4	C_DQ1	U1.8	C	DQ1	
5	M0_DQ1	U2.3	M0	DQ1	
6	M1_DQ1	U3.3	M1	DQ1	

[End Port Data]

# Comments and Discussion

- Logical and Physical Names?
- Reference Information?