S-parameter interconnect model ports and terminals

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Please accept my apologies for overlooking the sentence in red:

For an Interconnect Model using File_TS with N ports, N shall match the number of ports present in the data of the associated Touchstone 1.x file, or the value associated with the [Number of Ports] field in the associated Touchstone 2 file. **The Number_of_terminals entry in the Interconnect Model shall be an integer equal to N+1.**

This sentence takes care of my original concern regarding the last bullet:

- **Terminal N+1 shall be connected to a Pin, Pad, or Buffer Terminal which is in turn connected to a Pin with a signal_name of POWER or GND.**

which I (erroneously) thought would create a short between the "+" terminal of a port and the reference.
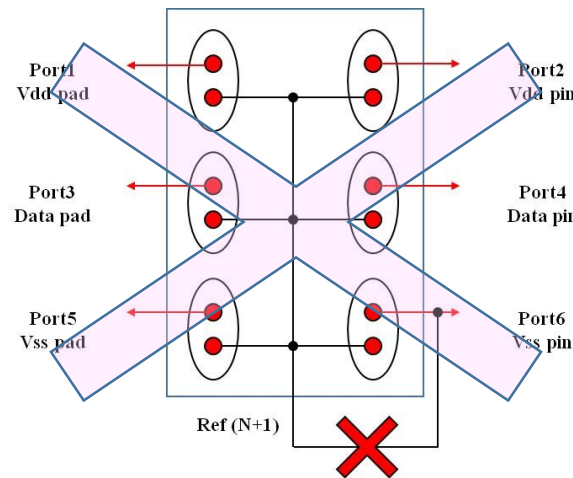
In "Draft 30" of the package/interconnect proposal we then have:

For an Interconnect Model using File_TS with N ports, **N shall match the number of ports present in the data** of the associated Touchstone 1.x file, or the value associated with the [Number of Ports] field in the associated Touchstone 2 file. **The Number_of_terminals entry in the Interconnect Model shall be an integer equal to N+1.** Terminal rules are described below:

- The EDA tool shall use the pin_name or signal_name specified for the associated **Terminal "N+1"** entry **as the reference node for each of the N ports**. For an Interconnect Model with N ports, the Terminals and Ports are associated as follows:

Terminal	Port
1	1
2	2
…	
N	N
N+1	reference

- If a Terminal with number less than or equal to N is not connected, then it shall be terminated by the EDA tool with a resistor to the node on Terminal N+1. The value of this resistance shall be the value associated with the Port Reference Impedance subparameter.
- **Terminal N+1 shall be connected to a Pin, Pad, or Buffer Terminal** which is in turn connected to a Pin with a signal_name of POWER or GND.
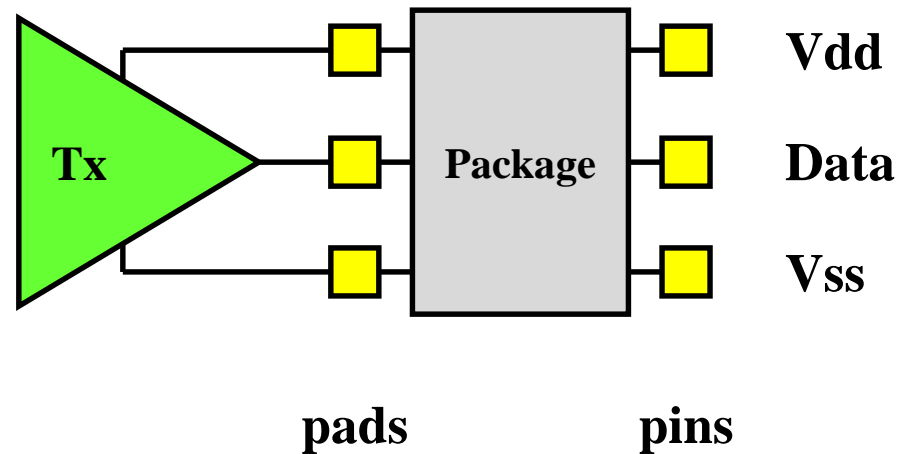
N = number of ports in .sNp file
N+1 = Number_of _terminals
The common reference for each port (N) is the N+1 terminal
Is the text in blue really needed (for reasons other than correct port ordering)?

A 1-buffer, 3-pad, 3-pin package model example to illustrate the proposal:

```
[Pin]        signal_name          model_name
1            Vdd                   POWER
2            Data                  Tx
3            Vss                   GND
```
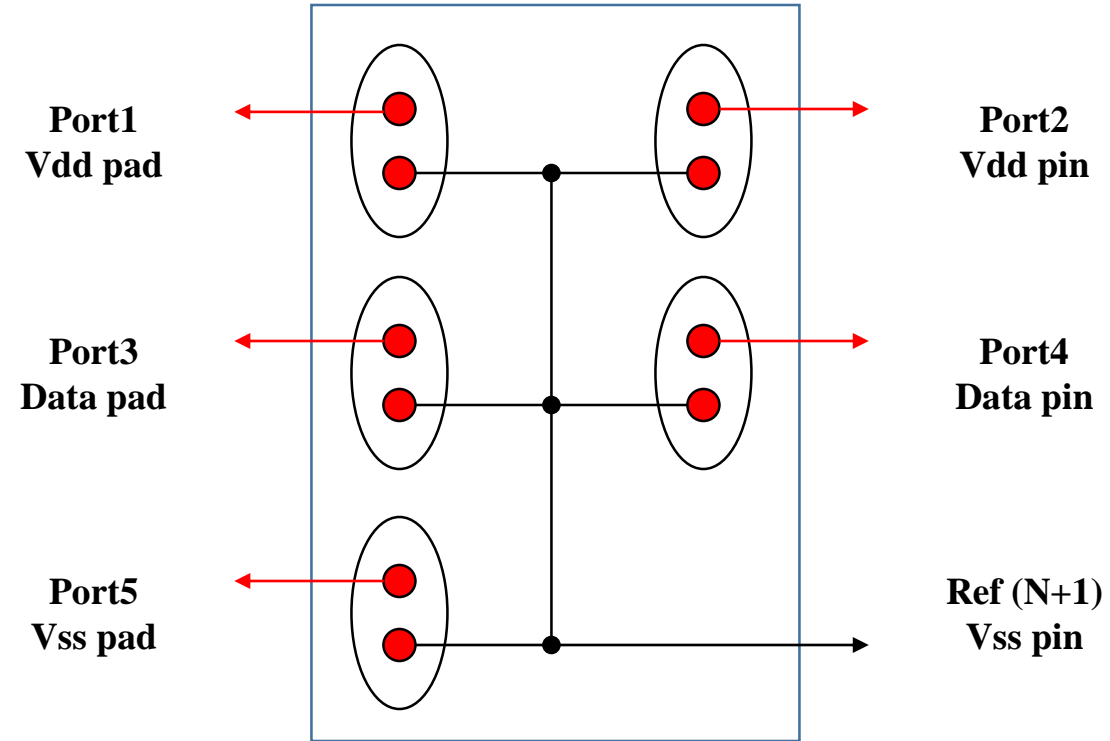

pads   pins

Number_of _terminals (N+1) = 6
Number of ports (N) = 5

The S-parameter package model for the example:

Port1
Vdd pad

Port2
Vdd pin

Port3
Data pad

Port4
Data pin

Port5
Vss pad

Ref (N+1)
Vss pin

**The 5-port (.s5p) S-parameter model
of the 6-terminal package model**
(Theoretically, any of the six terminals may be chosen as the reference).

However, the discussion in the February 23, 2016 ATM teleconference revealed another problem:
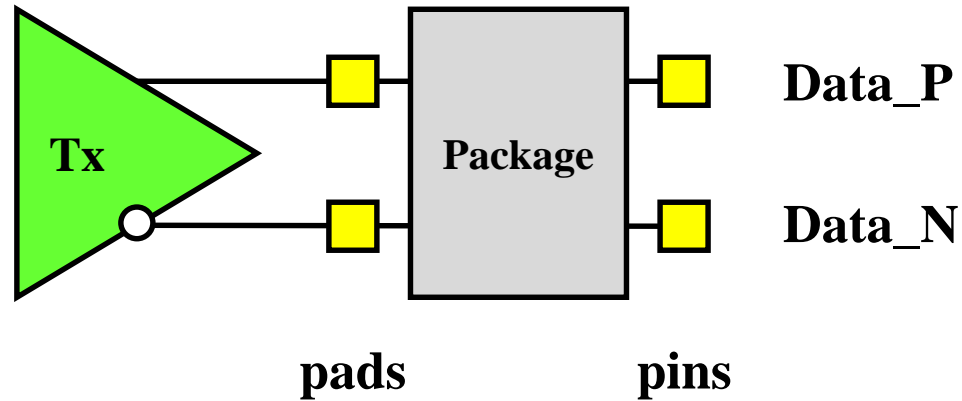
Most interconnect model makers generate S-parameter models with as many ports as the number of terminals.

For example: http://www.ieee802.org/3/bj/public/jan13/mellitz_3bj_01b_0113.pdf

IEEE 802.3bj Task Force
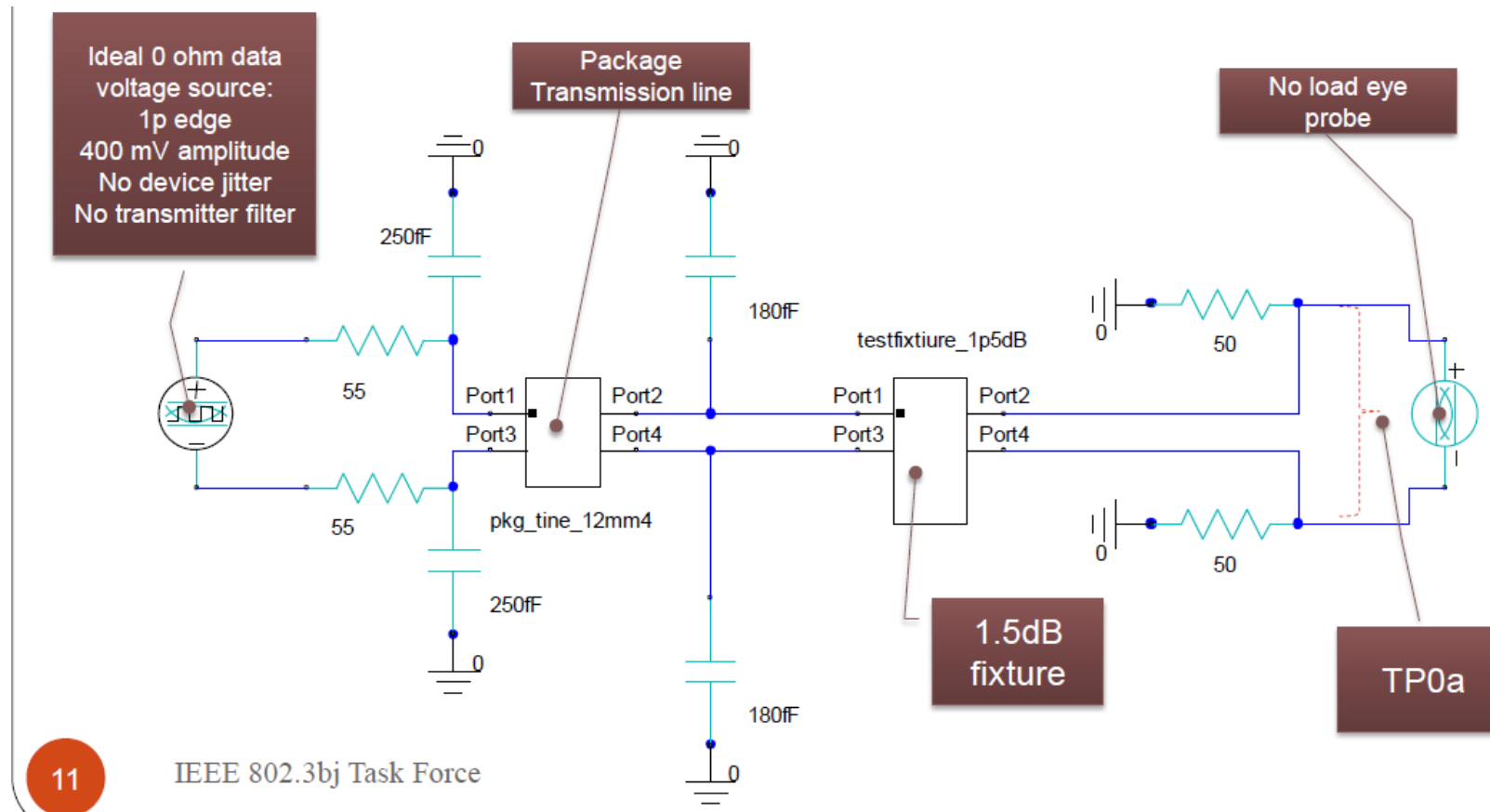
A differential buffer, 2-pad, 2-pin package model example:

```
[Pin]       signal_name        model_name
1           Data_P             Tx
2           Data_N             Tx
```
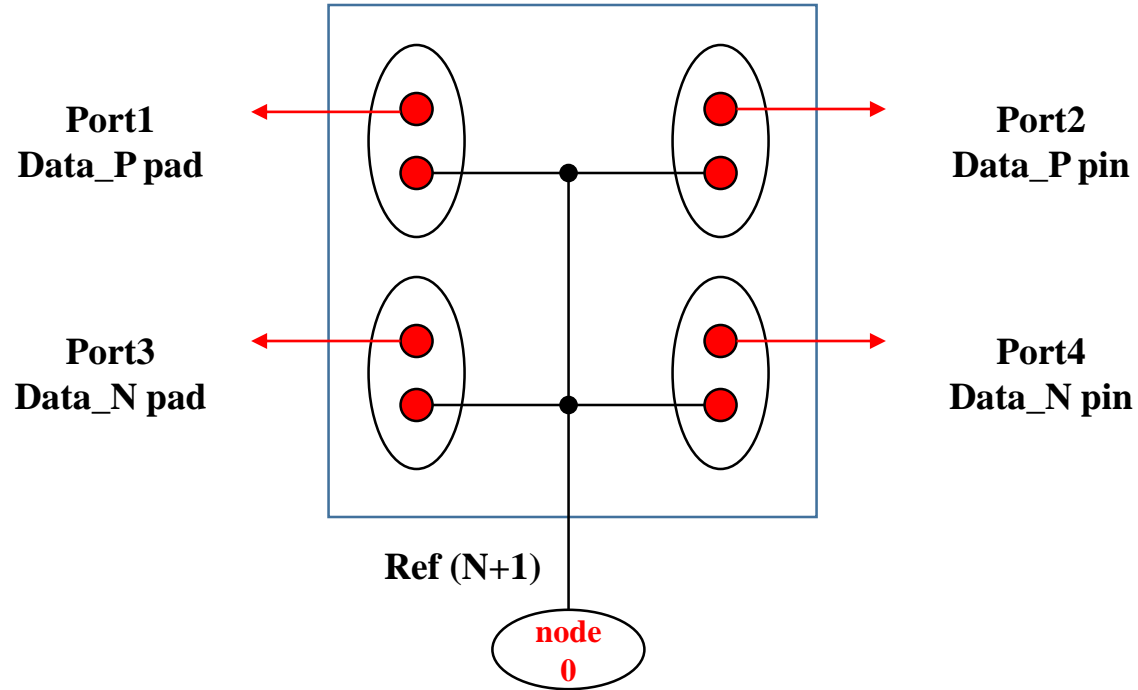

Number_of _terminals (N+1) should be = 4
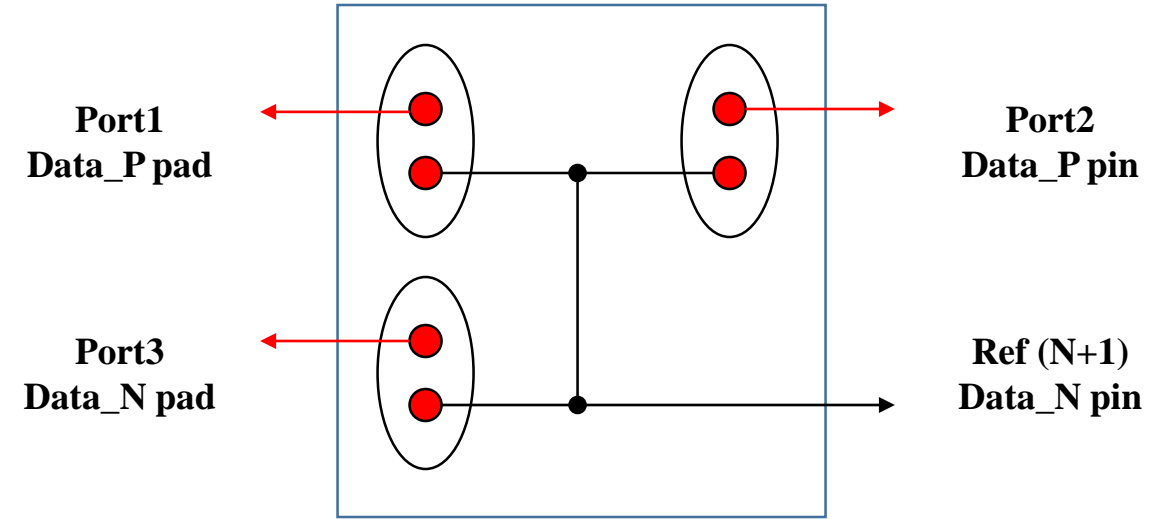**Number of ports (N) should be = 3**
But most model makers would generate an .s4p file for this package!

How should this be addressed in the package/interconnect modeling proposal?

A couple of options:

Port1
Data_P pad

Port2
Data_P pin

Port3
Data_N pad

Port4
Data_N pin

Ref (N+1)

node 0

Define the N+1 terminal as an "extra" connection to node 0?

Port1
Data_P pad

Port2
Data_P pin

Port3
Data_N pad

Ref (N+1)
Data_N pin

Force model makers to generate "NumberOfTerminals-1 port" S-parameter models?

Any other ideas, suggestions?

From Walter's email on February 23, 2016:

For an Interconnect Model using File_TS with N ports, **N shall match the number of ports present in the data** of the associated Touchstone 1.x file, or the value associated with the [Number of Ports] field in the associated Touchstone 2 file. The EDA tool shall choose a reference node for this S-parameter model. **This reference node could be connected to a POWER or GND pin of the component,** or a simulator internal reference node. If the model maker is concerned about accounting for the currents to this reference node, the model maker should wrap the Touchstone file inside of an IBIS-ISS subckt and make defined connections to the S-parameter port reference node(s). **The Number_of_terminals entry in the Interconnect Model shall be an integer equal to N.** Terminal rules are described below:

- For an Interconnect Model with N ports, the Terminals and Ports are associated as follows:
    - <u>Terminal</u>   <u>Port</u>
    - 1   1
    - 2   2
    - …
    - N   N
- If a Terminal with number less than or equal to N is not connected, then it shall be terminated by the EDA tool with a resistor to the reference node chosen by the simulator. The value of this resistance shall be the value associated with the Port Reference Impedance subparameter.

N = number of ports in .sNp file
N = Number_of _terminals
It is up to the EDA tool to decide how to connect the common reference node (N+1 terminal), but the above text allows it to be connected to a POWER or GND pin.
This brings us back to my original problem which was an oversight before, but now it is real.

The new text allows the ports of power or ground pins to be shorted to the common reference:
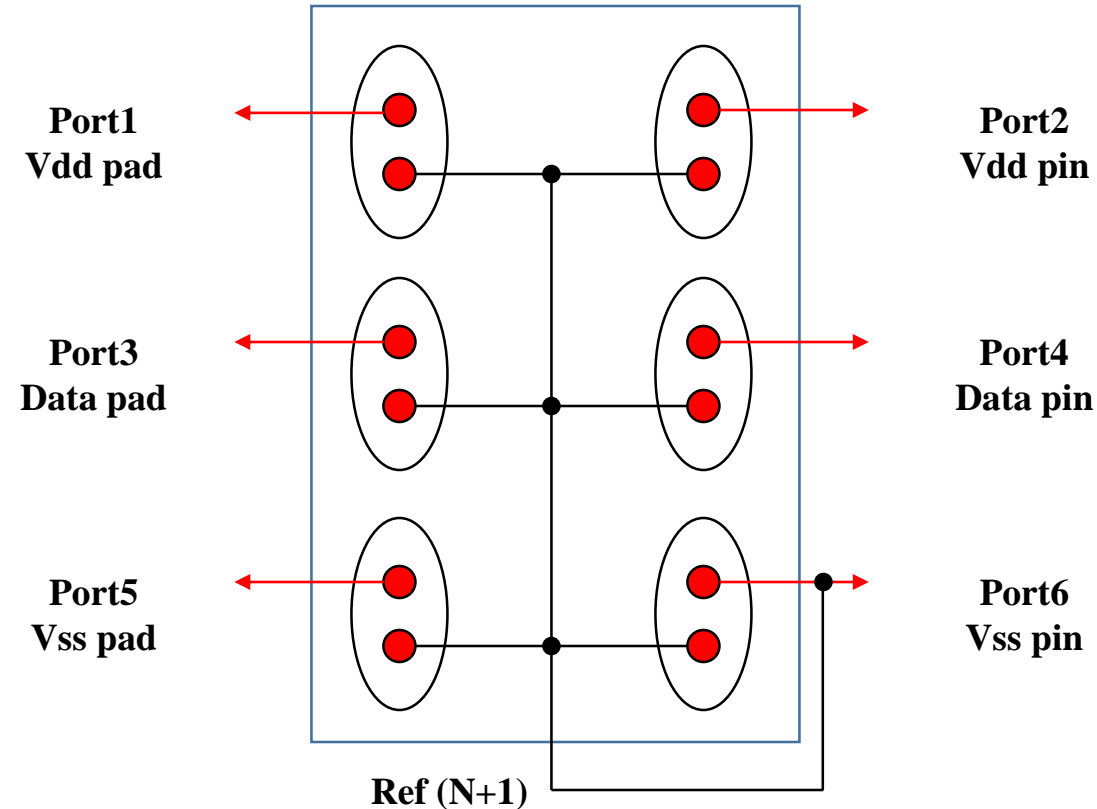
**The 6-port (.s6p) S-parameter model
of the 6-terminal package model**
"This reference node could be connected to a POWER or GND pin of the component..."