

# Receiver Thresholds Assume GND=0.0V=Node 0

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# [Receiver Thresholds] Assumes Node 0

- The **[Receiver Thresholds]** section throws a monkey wrench into all of our discussions about referencing.
- This section clearly deals with Device In Action, since it describes how receiver thresholds change when the voltage applied to the rails are not the voltages used for Device Under Test.
- **[Receiver Thresholds]** makes the assumption that
  - GND is Ground is 0.0V is Node 0, and that this is the reference node for all measurements DUT and DIA
  - Power aware simulations may not allow GND to “bounce”.
- I would hope that someone can find the error in my logic.
- If my logic is correct, we should accept the use of Node 0 when referencing interconnect W-line and Touchstone Files.

# Explaining [Receiver Thresholds] Using the Example on Pages 44/55.

## A fully specified single-ended 3.3 V CMOS receiver:

[Receiver Thresholds]

$V_{th} = 1.5V$

$V_{th\_min} = 1.45V$

$V_{th\_max} = 1.53V$

Threshold\_sensitivity = 0.45

Reference\_supply Power\_clamp\_ref

$V_{inh\_ac} = +200mV$

$V_{inh\_dc} = +100mV$

$V_{inl\_ac} = -200mV$

$V_{inl\_dc} = -100mV$

$T_{slew\_ac} = 400ps$

# Vinl\_dc and Vinh\_dc under DUT Conditions

For the Typ corner  $V_{th} = 1.5V$

So in this case, if the device is run in DUT conditions:

$$V_{inl\_dc} = 1.4 = 1.5 - .1$$

$$V_{inh\_dc} = 1.6 = 1.5 + .1$$



# Vinl\_dc and Vinh\_dc when Power\_clamp\_ref = 3.8V (DIA)

- Reference\_supply indicates which supply voltage Vth tracks
- In this example, Vth tracks Power\_clamp\_ref
- [POWER Clamp Reference] is 3.3
- When Power\_clamp\_ref is 3.8
  - $V_{th\_DIA} = V_{th} + (Power\_clamp\_ref - [POWER\ Clamp\ Reference]) * Threshold\_sensitivity$
  - $V_{th\_DIA} = 1.725 = 1.5 + (3.8 - 3.3) * Threshold\_sensitivity$
  - $V_{inl\_dc} = 1.625 = 1.725 - .1$
  - $V_{inh\_dc} = 1.825 = 1.725 + .1$

# What if Power\_clamp\_ref = 3.8V and GND\_clamp\_ref = 0.5V

$$V_{th} = 1.725 = 1.5 + (3.8 - 3.3) * \text{Threshold\_sensitivity}$$

- $V_{inl\_dc} = 1.625 = 1.725 - .1$
- $V_{inh\_dc} = 1.825 = 1.725 + .1$

But this makes no sense, we have shifted both rails by .5V so we need to shift the thresholds by .5V

- $V_{inl\_dc} = 1.9 = 1.4 + .5$
- $V_{inh\_dc} = 2.1 = 1.6 + .5$