

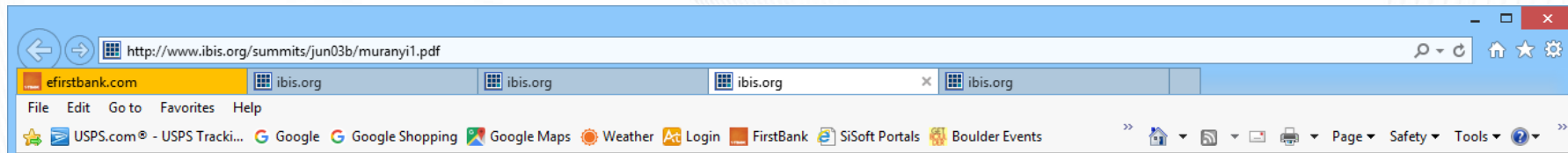
De Embedding C_comp IBIS-ISS Subckts

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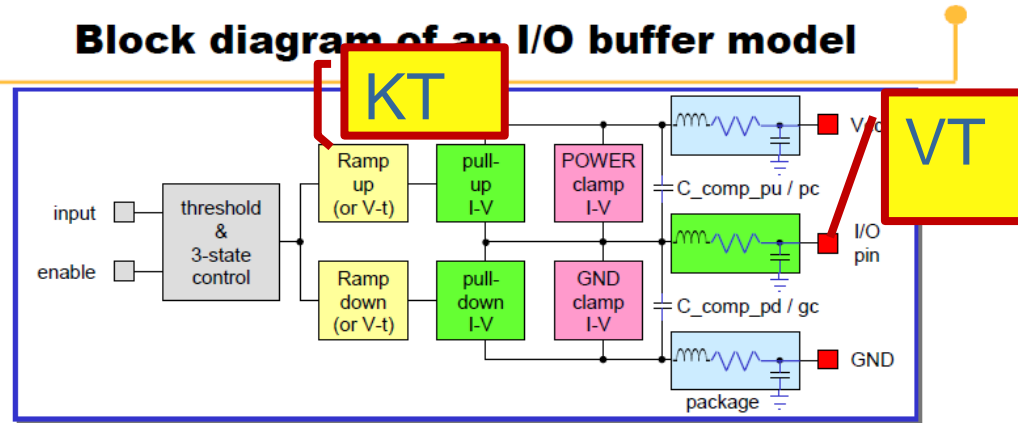
Overview

- What is C_comp De-Embedding
- What if C_comp is an IBIS-ISS Subcircuit?
- Sweep Simple C_comp to Get Best VT Fit
- Use KT_Fit with C_comp=0.0 to Generate VT_Fit
- Finished Model has VT_Fit, C_comp = 0. and C-Comp IBIS-ISS Subckt
- Summary of the Method
- What the C-comp Subckt BIRD Can Say

What is C_comp De-Embedding



Block diagram of an I/O buffer model



- What KT Curve Generates the
- VT Curve? original concept:
- <http://www.ibis.org/summits/jun03b/muranyi1.pdf>



• The passive package circuit is modeled separately from the buffer

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Page 4



What if C_comp is an IBIS-ISS Subcircuit?

Block diagram of an I/O buffer model

The diagram illustrates the internal structure of an I/O buffer. It includes an input and enable signal connected to a 'threshold & 3-state control' block. This block controls two paths: 'Ramp up (or V-t)' and 'Ramp down (or V-t)'. Each ramp path is followed by a 'pull-up I-V' or 'pull-down I-V' block, and then a clamp block: 'POWER clamp I-V' and 'GND clamp I-V'. The output of the buffer is connected to an 'I/O pin', which is also connected to a 'GND' reference. A 'C_comp Subcckt package' is connected to the output pin. A yellow box labeled 'KT' is connected to the ramp blocks, and another yellow box labeled 'VT' is connected to the output pin.

- What KT Curve Generates the
- VT Curve? Not so simple!
- ?
- ?
- The passive package circuit is modeled separately from the buffer

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CPD

Sweep Simple C_comp to Get Best VT Fit

Block diagram of an I/O buffer model

The diagram illustrates the internal structure of an I/O buffer. It starts with an **input** and an **enable** signal entering a **threshold & 3-state control** block. This block drives two **Ramp** blocks: **Ramp up (or V-t)** and **Ramp down (or V-t)**. These ramps are connected to **pull-up I-V** and **pull-down I-V** blocks, respectively. The pull-up block is also connected to a **POWER clamp I-V** block, and the pull-down block is connected to a **GND clamp I-V** block. The output of the pull-up block is the **I/O pin**, which is also connected to a **VT** (threshold voltage) block. The output of the pull-down block is connected to **GND**. The diagram also shows **Sweep Simple C_comp_fit** and **Sweep Simple C_comp_fit** labels. A yellow box labeled **KT_Fit** is drawn around the Ramp blocks, and another yellow box labeled **VT** is drawn around the I/O pin output. A red arrow points from **VT** to the I/O pin label.

- Sweep Simple C_comp, Find
- C_comp_fit that Generates Best
- VT Fit, Remember this KT_Fit
- (Could implement a more sophisticated method to generate KT_Fit)

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Use KT_Fit with C_comp=0.0 to Generate VT_Fit

Block diagram of an I/O buffer model

input enable

threshold & 3-state control

Ramp up (or V-t)

Ramp down (or V-t)

pull-up I-V

pull-down I-V

POWER clamp I-V

GND clamp I-V

$C_{comp} = 0.0$

Vcc

I/O pin

GND

KT_Fit

VT_Fit

- Use KT_Fit with $C_{comp} = 0.0$
- To Generate a new VT_Fit
- The passive package circuit is modeled separately from the buffer

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Finished Model has VT_Fit, C_comp = 0. and C-Comp IBIS-ISS Subckt

Block diagram of an I/O buffer model

The diagram shows an I/O buffer model with the following components and connections:

- Inputs:** 'input' and 'enable' are connected to a 'threshold & 3-state control' block.
- Control Logic:** The 'threshold & 3-state control' block outputs to 'Ramp up (or V-t)' and 'Ramp down (or V-t)' blocks.
- Driver Stages:** The ramp blocks are connected to 'pull-up I-V' and 'pull-down I-V' blocks.
- Clamp Stages:** The pull-up/down blocks are connected to 'POWER clamp I-V' and 'GND clamp I-V' blocks.
- Output:** The output of the clamp stages is connected to the 'I/O pin'.
- Power and Ground:** 'Vcc' and 'GND' are connected to the clamp stages.
- Model Parameters:** 'KT_Fit' is associated with the ramp blocks, and 'VT_Fit' is associated with the clamp stages.
- Subcircuit Labels:** 'C_comp Subckt' and 'package' are labeled at the bottom of the diagram.

- EDA Tool will generate **KT_Fit**
- from **VT_Fit** with $C_{comp} = 0.0!$
- EDA Tool then adds **C_comp** subckt

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Summary of This Method

- Find a solution with an effective C_comp (C_comp_fit) along with a KT_Fit that generates the measured VT curves with the complex C_comp Subckt
- Use that KT_Fit, along with a C_comp=0. to generate a VT_Fit
- Use this VT_Fit with C_comp=0. and C_comp IBIS-ISS subckt

What the C-comp Subckt BIRD Can Say

- If there is a C_comp subckt, the EDA tool shall include both the C_comp (or C_comp* [Model]) sub-params and the C_comp subckt in simulations.
- If there is a C-comp subckt, the EDA tool shall assume that the VT curves are based on the IV curves and the the C_comp (or C_comp* [Model]) sub-params, and specifically not the C_comp subckt.
- The value of C_comp may be zero if there is a C_comp subckt.