Case Study: Using IBIS Buffer Models for Pre-emphasis

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Pre-emphasis Application
IBIS Buffer Models for Pre-emphasis

• Extract Buffer Data for Main Source
• Extract Buffer Data for Boost Source
  – From common applications, they could be scaled from Main Sources
• Stimulus Delay for Boost Source
It works

• An example
It works
(Parameter Setting)

("pre-emphasis_driver"
(MacroModel
(MacroType TDiffIO )
(NumberOfTerminals 8
(Parameters
(Buffers
(BUFF pre_emph_dB_drvr )
(MinTypMaxParams
(eqdb -3.5 )
(bitp 400p )
(padcap 0.3p) 
(SubCircuits "

Equalization Fact
(Main Source vs. Boost Source)

Bit Width

C_comp
It works
(Boost Source Scaling)

```
.param eqf='1.0 - (10.0 ^ (eqdb/20.0))'
.param cf1='cf0 * eqf'

xtx0 nvdd out ngnd in0 en tx scale='cf0'
xtx1 nvdd out ngnd in1 en tx scale='cf1'

.subckt tx nvdd out ngnd in en scale=1
bdrvr nvdd out ngnd in en Model=BUFF File=ibis_file c_compX=0 + VIScale_pulldown='scale' ......
.ends tx
```

Scale conversion
Circuit calls with Scaling fact
Bdrvr element

You can use other Spice Syntax to produce the same functionality
It works

(Stimulus Delay)

xin0 in0 in ngnd delayin inv=inv0
xin1 in1 in ngnd delayin inv=inv1 del='bitp'

.subckt delayin in1 in ngnd inv=0 del=0
einp in2 ngnd v='inv * (1 - v(in,ngnd)) + (1-inv) * v(in,ngnd)'
ein1 in1 ngnd pwl in2 ngnd delay=del
datapoints vv
0 0
1 1
end vv
.ends delayin

You can use other Spice Syntax
to produce the same functionality
It works
(Results)
It works

(Results)
It works
(Results)
It works

(Result)
It works
(Results)
Conclusions

• Keys for IBIS Implementation
  – Boost Source Data Extraction
  – Main Source Scaling
  – C-comp and Internal Terminations
  – Stimulus Delay (1 bit for Pre-emphasis)
• More Complicated DSP Applications are coming
What IBIS could do
(Discussion)

• Support Scalable Current Sources
  – Add “Scale Fact” into [Pin] section
  – Or, Introduce “Scaled” [Model] Refer to the Main Source

• Support Multiple Stimulus Inputs with Delays
  – Add “Stimulus Delay” into [Model] section