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The Golden Waveform for QA?

Manfred Maurer **manfred.maurer@siemens.com**

Christian Sporrer **christian.sporrer@infineon.com**

Overview

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Quality Assurance (QA) – important modeling aspect

- **By Quality Report**
- **By Golden Waveform (GWF)**

Golden Waveform Example

Outlook

Quality Report

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Essential QA requirement from IBIS model users is the comparison of SPICE and IBIS simulation results for dedicated test cases.

- **By Quality Report:**
  - **Huge effort for running the simulations and writing the text document.**
  - **Mostly done by hand.**

Quality Report

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- **PRO**
  - **Parameters and values are defined.**
  - **Procedures for deriving the IBIS data.**
  - **Interpretation of the IBIS-curves.**
  - **Comprehensive IBIS-model information.**
  - **Quality of the model is quantified.**
- **CON**
  - **NO standardized format for automated use !**
  - **NO automated way for checking QA criteria.**

Quality Report

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Why not use the GWF container to concentrate all Quality Information ?

- **The actual defined Golden Waveforms contains the quintessence of Quality Requirements.**

  ➔The user can evaluate the Quality of the IBIS Model by simulating with the TEST_LOAD.

  ➔ The vendor can use the same methodology for extracting GWF as for generating the normal waveform data.

Additional GWF Information

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- **By Golden Waveform (GWF):**
  - **Use of GWF container also for representing a IBIS waveform with TEST_LOAD.**
  - **The simulation setup for SPICE can be reused for IBIS (Simple change of buffer instance e.g. in HSPICE).**
  - **Waveform comparison with customer IBIS tool waveform viewer (all relevant information is available via the model) ➔ NO need to simulate, to evaluate the model quality.**
  - **New KEYWORD needed.**
  - **Easy way for automation.**

Testload Definition

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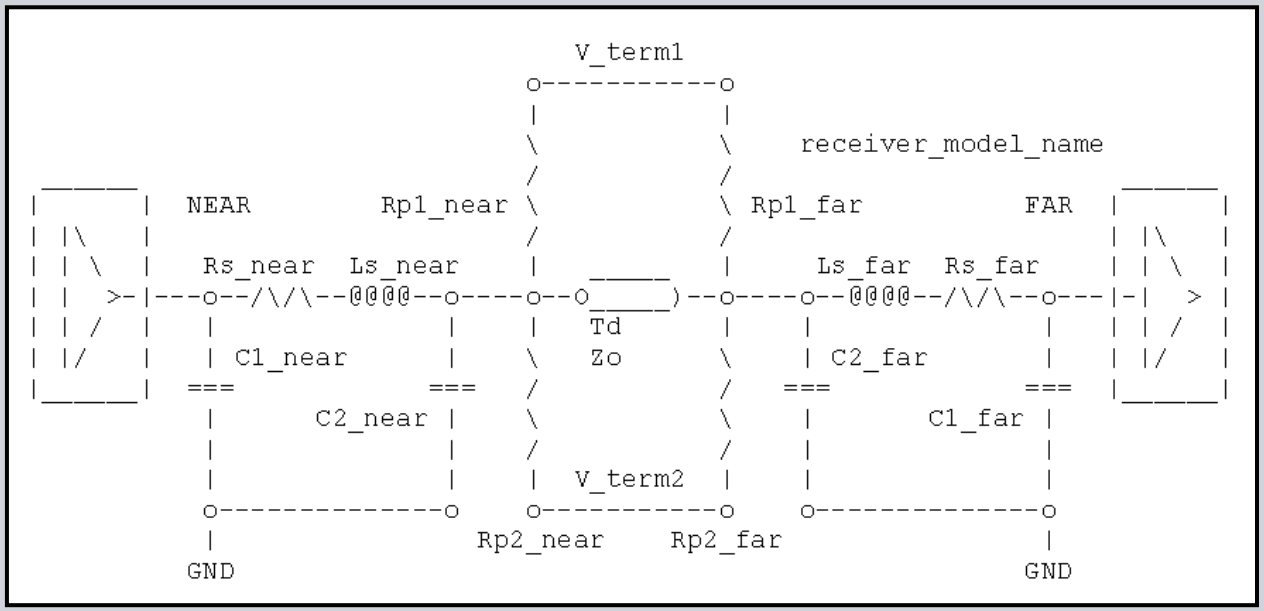

C1_near	= 2.0000000e-12
Rs_near	= 2.7000000e+01
Ls_near	= 1.0000000e-15
C2_near	= 1.0000000e-12
Rp1_near	= 1.0000000e+09
Rp2_near	= 1.0000000e+09
Td	= 2.0000000e-09
Zo	= 5.0000000e+01
Rp1_far	= 1.0000000e+02
Rp2_far	= 1.0000000e+02
C2_far	= 1.0000000e-12
Ls_far	= 2.5000000e-10
Rs_far	= 1.0000000e-06
C1_far	= 2.0000000e-12

Example of a GWF

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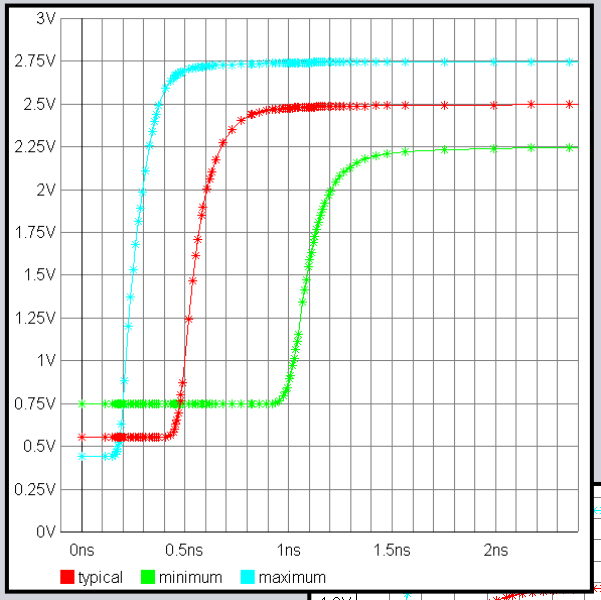
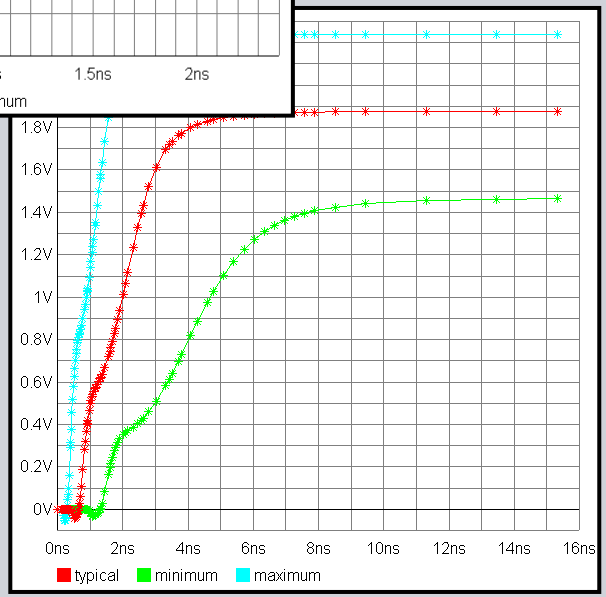
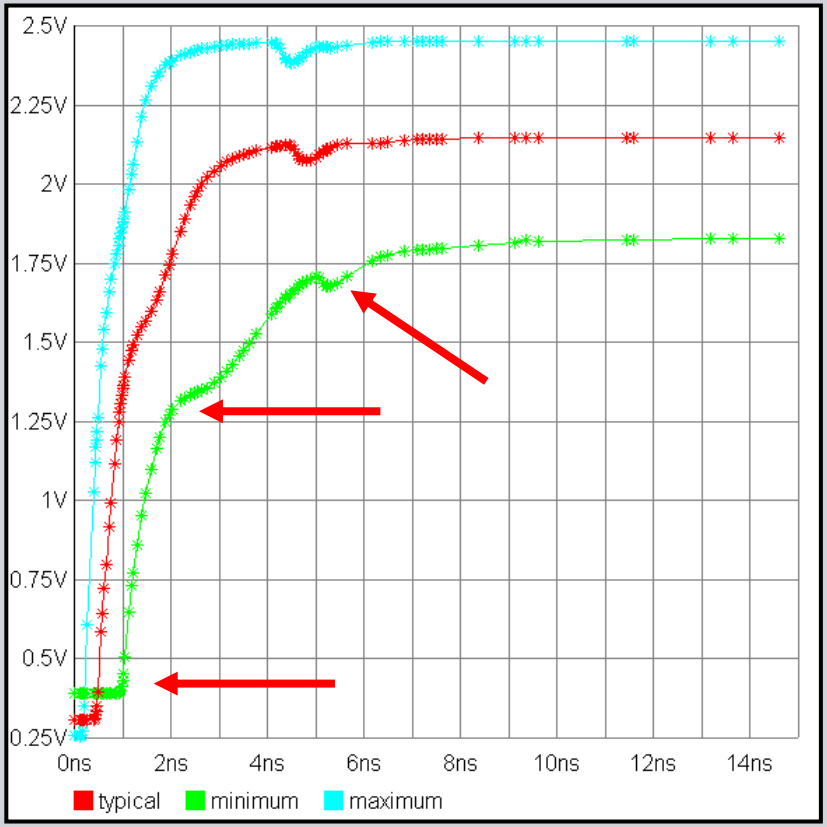
RWF_2_Vdd



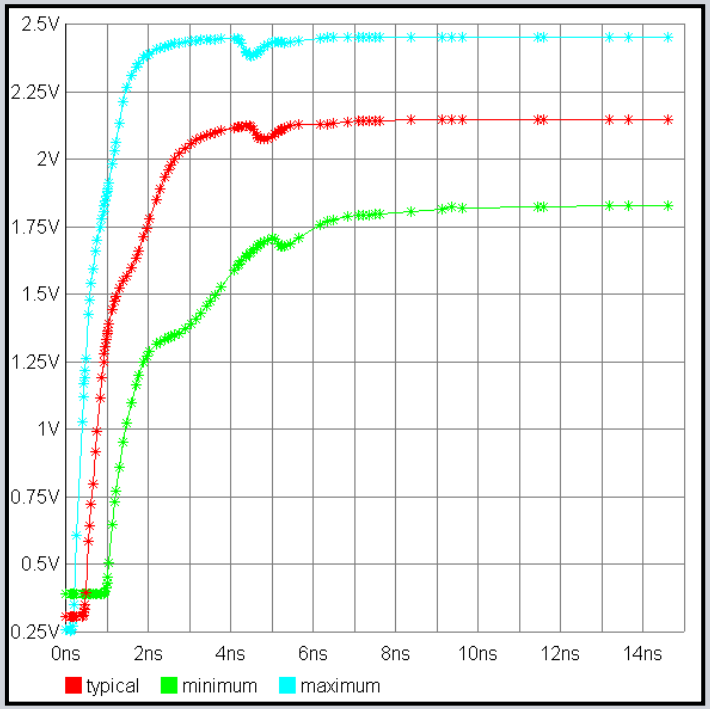
RWF_2_GND



RWF_NEAR@GWF

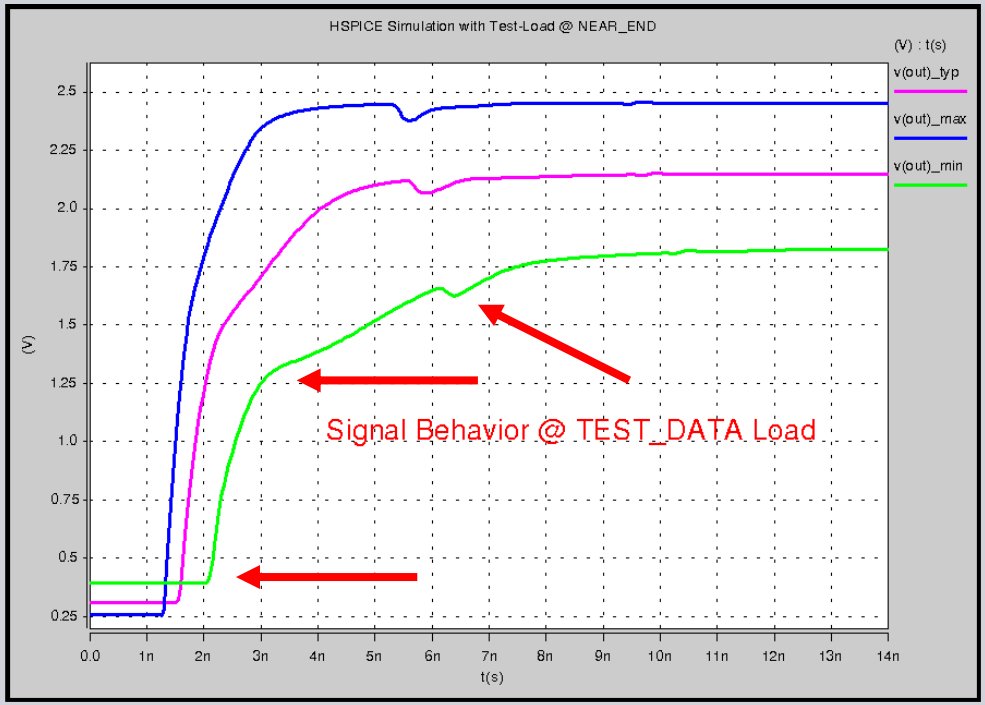


Comparison GWF vs. HSPICE



RWF_NEAR@GWF

RWF @ NEAR with HSPICE



Test Data / GWF

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- **PRO**
  - **Well defined Test Load.**
  - **GWF generation with the same procedure as the IBIS model.**
  - **Automated procedure for model evaluation.**
  - **Automated procedure for model usability test,**
    correlation IBIS model ⟷ EDA-tool /-environment,
    correlation IBIS model ⟷ SPICE simulation.
- **CON**
  - **Numerical problems caused by resonance effects and mismatch of transmission line delay time and signal slew rate.**
  - **Can result in huge amount of data points.**

Outlook

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- Test Data – Golden Waveform for QA ?
- Additional Improvements of the GWF:
  - More Testpoints, than NEAR and FAR ?
  - More pulses or a single R/F-edge ?
  - Defined testload, adequate to the IBIS application ?
  - Automated data handling for the GWF ?
  - IBIS viewer to visualize GWF and quantify the model quality ?
  - Criteria to avoid numerical problems ?
  - Intelligent data compression required.

Discussions

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Thank you for your attention