IBIS/HSPICE Model Quality Report

Design ID- u48b
Description-1Gb DDR-2 SDRAM
Marketing device name(s): MT47H256M4HQ, MT47H128M8HQ,MT47H64M16HR, MT47H256M4HQ-IT, MT47H128M8HQ-IT, MT47H64M16HR-IT, MT47H256M4U48B, MT47H128M8U48B, MT47H64M16U48B, MT47H256M4U48B-IT, MT47H128M8U48B-IT, MT47H64M16U48B-IT,
Zip File Name:u48b_ibis.zip, u48b_bd_ibis.zip, u48b_it_ibis.zip, u48b_bd_it_ibis.zip
IBIS File name: u48b.ibs, u48b_bd.ibs, u48b_it.ibs, u48b_bd_it.ibs File rev: 2.1
HSPICE File name: u48b_hspice.zip File rev: 2.1
EBD file name (if applicable): File rev:
Die Rev: E
Date: June 21, 2007
Datasheet Link (include datasheet link from micron.com)
http://download.micron.com/pdf/datasheets/dram/ddr2/1GbDDR2.pdf

E-mail at modelsupport@micron.com for questions regarding Quality Report

IBIS Quality Summary

1. ☒ Include the IBIS Quality Summary information in the Quality report. For details on IBIS Quality check the quality specification and quality checklist on IBIS quality webpage http://www.vhdl.org/pub/ibis/quality_wip/

   Include the Ibis quality levels for all components and models in the Ibis file.

   |IQ SUMMARY Overall Quality of component and models Level 2b
   |
   |IQ Level 0 - 0 errors 0 warnings
   |IQ Level 1 - All checks done for completeness and correctness
   |IQ Level 2 - HSPICE Correlation
   |IQ Buffer DQFULL_533/DQFULL_ODT50_533/DQFULL_ODT75_533/DQFULL_ODT150_533: Quality level 2b
   |IQ Buffer DQFULL_667/DQFULL_ODT50_667/DQFULL_ODT75_667/DQFULL_ODT150_667: Quality level 2b
   |IQ Buffer DQFULL_1066/DQFULL_ODT50_1066/DQFULL_ODT75_1066/DQFULL_ODT150_1066: Quality level 2b

|IQ Buffer DQHALF_533/DQHALF_ODT50_533/DQHALF_ODT75_533/DQHALF_ODT150_533: Quality level 2b
|IQ Buffer DQHALF_667/DQHALF_ODT50_667/DQHALF_ODT75_667/DQHALF_ODT150_667: Quality level 2b
|IQ Buffer DQHALF_1066/DQHALF_ODT50_1066/DQHALF_ODT75_1066/DQHALF_ODT150_1066: Quality level 2b

|IQ Buffer RDQS_FULL_533/RDQS_HALF_533: Quality level 2b
|IQ Buffer RDQS_FULL_667/RDQS_HALF_667: Quality level 2b
|IQ Buffer RDQS_FULL_1066/RDQS_HALF_1066: Quality level 2b
|IQ Buffer DM_INPUT_533/DM_ODT50_533/DM_ODT75_533/DM_ODT150_533: Quality level 2b
|IQ Buffer DM_INPUT_667/DM_ODT50_667/DM_ODT75_667/DM_ODT150_667: Quality level 2b
|IQ Buffer DM_INPUT_1066/DM_ODT50_1066/DM_ODT75_1066/DM_ODT150_1066: Quality level 2b
|
|IQ Level 1
| All Level 1 checks performed and are either OK or NA
|
|IQ Level 2
| Using VT IBIS Data compared to source hspice models
|
|IQ Level 2b
| C_comp laboratory and hspice correlation
|
|IQ BEGIN IBIS Quality Checklist

	IQ FILE: u48b.ibs, u48b_bd.ibs, u48b_it.ibs, u48b_bd_it.ibs	IQ Level: 1
	IQ COMPONENT: MT47H256M4HQ	IQ Level: 1
	IQ COMPONENT: MT47H256M4HQ_CLP	IQ Level: 1
	IQ COMPONENT: MT47H128M8HQ	IQ Level: 1
	IQ COMPONENT: MT47H128M8HQ_CLP	IQ Level: 1
	IQ COMPONENT: MT47H64M16HR	IQ Level: 1
	IQ COMPONENT: MT47H64M16HR_CLP	IQ Level: 1
	IQ COMPONENT: MT47H256M4HQ_IT	IQ Level: 1
	IQ COMPONENT: MT47H256M4HQ_IT_CLP	IQ Level: 1
	IQ COMPONENT: MT47H128M8HQ_IT	IQ Level: 1
	IQ COMPONENT: MT47H128M8HQ_IT_CLP	IQ Level: 1

|IQ COMPONENT: MT47H64M16HR_IT IQ Level: 1
|IQ COMPONENT: MT47H64M16HR_IT_CLP IQ Level: 1
|IQ COMPONENT: MT47H256M4U48B IQ Level: 1
|IQ COMPONENT: MT47H128M8U48B IQ Level: 1
|IQ COMPONENT: MT47H64M16U48B IQ Level: 1
|IQ COMPONENT: MT47H256M4U48B_IT IQ Level: 1
|IQ COMPONENT: MT47H128M8U48B_IT IQ Level: 1
|IQ COMPONENT: MT47H64M16U48B_IT IQ Level: 1

|IQ MODEL: DQFULL_533 IQ Level: 2b
|IQ MODEL: DQFULL_533_ODT50 IQ Level: 2b
|IQ MODEL: DQFULL_533_ODT75 IQ Level: 2b
|IQ MODEL: DQFULL_533_ODT150 IQ Level: 2b
|IQ MODEL: DQHALF_533 IQ Level: 2b
|IQ MODEL: DQHALF_533_ODT50 IQ Level: 2b
|IQ MODEL: DQHALF_533_ODT75 IQ Level: 2b
|IQ MODEL: DQHALF_533_ODT150 IQ Level: 2b
|IQ MODEL: RDQS_FULL_533 IQ Level: 2b
|IQ MODEL: RDQS_HALF_533 IQ Level: 2b
|IQ MODEL: DM_INPUT_533 IQ Level: 2b
|IQ MODEL: DM_ODT50_533 IQ Level: 2b
|IQ MODEL: DM_ODT75_533 IQ Level: 2b
|IQ MODEL: DM_ODT150_533 IQ Level: 2b
|IQ MODEL: INPUT_533 IQ Level: 2b
|IQ MODEL: CLKIN_533 IQ Level: 2b

|IQ MODEL: DQFULL_667 IQ Level: 2b
|IQ MODEL: DQFULL_667_ODT50 IQ Level: 2b
|IQ MODEL: DQFULL_667_ODT75 IQ Level: 2b
|IQ MODEL: DQFULL_667_ODT150 IQ Level: 2b
|IQ MODEL: DQHALF_667 IQ Level: 2b
|IQ MODEL: DQHALF_667_ODT50 IQ Level: 2b
|IQ MODEL: DQHALF_667_ODT75 IQ Level: 2b
|IQ MODEL: DQHALF_667_ODT150 IQ Level: 2b
|IQ MODEL: RDQS_FULL_667 IQ Level: 2b
|IQ MODEL: RDQS_HALF_667 IQ Level: 2b
|IQ MODEL: DM_INPUT_667 IQ Level: 2b
|IQ MODEL: DM_ODT50_667 IQ Level: 2b
|IQ MODEL: DM_ODT75_667 IQ Level: 2b
|IQ MODEL: DM_ODT150_667 IQ Level: 2b
|IQ MODEL: INPUT_667 IQ Level: 2b
|IQ MODEL: CLKIN_667 IQ Level: 2b

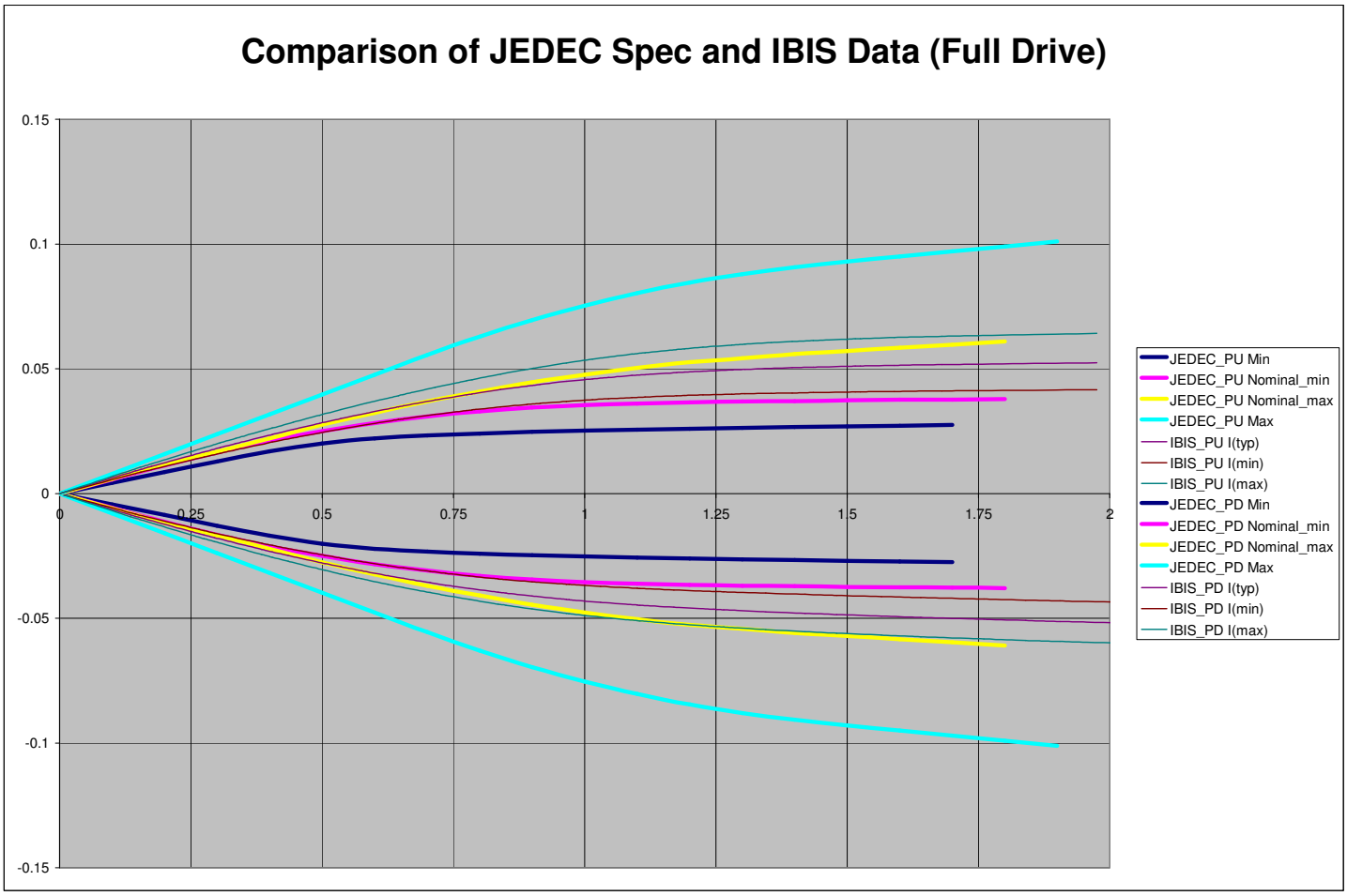
|IQ MODEL: DQFULL_1066	IQ Level:	2b
|IQ MODEL: DQFULL_667_ODT50	IQ Level:	2b
|IQ MODEL: DQFULL_667_ODT75	IQ Level:	2b
|IQ MODEL: DQFULL_667_ODT150	IQ Level:	2b
|IQ MODEL: DQHALF_1066	IQ Level:	2b
|IQ MODEL: DQHALF_667_ODT50	IQ Level:	2b
|IQ MODEL: DQHALF_667_ODT75	IQ Level:	2b
|IQ MODEL: DQHALF_667_ODT150	IQ Level:	2b
|IQ MODEL: RDQS_FULL_1066	IQ Level:	2b
|IQ MODEL: RDQS_HALF_1066	IQ Level:	2b
|IQ MODEL: DM_INPUT_1066	IQ Level:	2b
|IQ MODEL: DM_ODT50_1066	IQ Level:	2b
|IQ MODEL: DM_ODT75_1066	IQ Level:	2b
|IQ MODEL: DM_ODT150_1066	IQ Level:	2b
|IQ MODEL: INPUT_1066	IQ Level:	2b
|IQ MODEL: CLKIN_1066	IQ Level:	2b
|IQ MODEL: NF_INPUT	IQ Level:	2b

|IQ END IBIS Quality Checklist

IBIS MODEL Correlation

Datasheet Correlation

1. ☒ For Output model or I/O model compare datasheet IOH/IOL data with Ibis pullup/pulldown data.



2. ☒ Compare C_comp with datasheet Input C. Provide c_comp comparison table for all models and for all package combinations (i.e x4, x8 and x16)

Insert component name here **MT47H256M4HQ**

		IBIS		Datasheet	
		Min	max	min	max
DQ	C_comp	3.06pF	3.47pF		
	C package	0.09pF	0.17pF		
	C_total	3.15pF	3.64pF	2.5pF	3.5pF
INPUT	C_comp	1.16pF	1.54pF		
	C package	0.08pF	0.14pF		
	C_total	1.24pF	1.68pF	1.0pF	1.75pF
CLK	C_comp	1.25pF	1.52pF		
	C package	0.12pF	0.13pF		
	C_total	1.37pF	1.65pF	1.0pF	2.0pF

Insert component name here **MT47H128M8HQ**

		IBIS		Datasheet	
		Min	max	min	max
DQ	C_comp	3.06pF	3.47pF		
	C package	0.09pF	0.17pF		
	C_total	3.15pF	3.64pF	2.5pF	3.5pF
INPUT	C_comp	1.16pF	1.54pF		
	C package	0.08pF	0.14pF		
	C_total	1.24pF	1.68pF	1.0pF	1.75pF
CLK	C_comp	1.25pF	1.52pF		
	C package	0.12pF	0.13pF		
	C_total	1.37pF	1.65pF	1.0pF	2.0pF

Insert component name here **MT47H64M16HR**

		IBIS		Datasheet	
		Min	max	min	Max
DQ	C_comp	3.06pF	3.47pF		
	C package	0.12pF	0.18pF		
	C_total	3.18pF	3.65pF	2.5pF	3.5pF
INPUT	C_comp	1.16pF	1.54pF		
	C package	0.11pF	0.16pF		
	C_total	1.27pF	1.70pF	1.0pF	1.75pF
CLK	C_comp	1.25pF	1.52pF		
	C package	0.13pF	0.13pF		
	C_total	1.38pF	1.65pF	1.0pF	2.0pF

3. ☐ If slew rate specifications (Rise slew and Fall slew) are available from the datasheet, complete Hspice simulation to generate slew rate data and provide a comparison table.

   Not available

Measurement Correlation

1. ☒ For Output model or I/O model compare measured IOH/IOL data with Ibis pullup pulldown data. If the measurement condition is different than Ibis condition, run hspice simulation using the same measurement condition, for example Vcc, temp and process. Include measurement conditions in the pullup/pulldown images.

   Not available

2. ☒ Compare c_comp with measured c_comp. Provide c_comp comparison table for all models and for all package combinations (i.e x4, x8 and x16)

Insert component name here **MT47H256M4HQ**

		IBIS			Measured		
		min	Typ	max	min	typ	max
DQ	C_comp	3.06pF	3.24pF	3.47pF	NA	NA	NA
	C package	0.09pF	0.11pF	0.17pF	NA	NA	NA
	C_total	3.15pF	3.35pF	3.64pF	3.21pF	3.28pF	3.48pF
INPUT	C_comp	1.16pF	1.35pF	1.54pF	NA	NA	NA
	C package	0.08pF	0.1pF	0.14pF	NA	NA	NA
	C_total	1.24pF	1.45pF	1.68pF	1.34pF	1.44pF	1.58pF
CLK	C_comp	1.25pF	1.38pF	1.52pF	NA	NA	NA
	C package	0.12pF	0.13pF	0.13pF	NA	NA	NA
	C_total	1.37pF	1.51pF	1.65pF	1.49pF	1.5pF	1.51pF

Insert component name here **MT47H128M8HQ**

		IBIS			Measured		
		min	Typ	max	min	typ	max
DQ	C_comp	3.06pF	3.24pF	3.47pF	NA	NA	NA
	C package	0.09pF	0.13pF	0.17pF	NA	NA	NA
	C_total	3.15pF	3.37pF	3.64pF	3.2pF	3.36pF	3.56pF
INPUT	C_comp	1.16pF	1.35pF	1.54pF	NA	NA	NA
	C package	0.08pF	0.1pF	0.14pF	NA	NA	NA
	C_total	1.24pF	1.45pF	1.68pF	1.38pF	1.47pF	1.61pF
CLK	C_comp	1.25pF	1.38pF	1.52pF	NA	NA	NA
	C package	0.12pF	0.13pF	0.13pF	NA	NA	NA
	C_total	1.37pF	1.51pF	1.65pF	1.55pF	1.55pF	1.55pF

Insert component name here **MT47H64M16HR**

		IBIS			Measured		
		min	Typ	max	min	typ	max
DQ	C_comp	3.06pF	3.24pF	3.47pF	NA	NA	NA
	C package	0.12pF	0.15pF	0.18pF	NA	NA	NA
	C_total	3.18pF	3.39pF	3.65pF	3.3pF	3.44pF	3.6pF
INPUT	C_comp	1.16pF	1.35pF	1.54pF	NA	NA	NA
	C package	0.11pF	0.13pF	0.16pF	NA	NA	NA
	C_total	1.27pF	1.48pF	1.70pF	1.43pF	1.49pF	1.57pF
CLK	C_comp	1.25pF	1.38pF	1.52pF	NA	NA	NA
	C package	0.13pF	0.13pF	0.13pF	NA	NA	NA
	C_total	1.38pF	1.51pF	1.65pF	1.48pF	1.49pF	1.51pF

3. ☐ Compare ODT Data with Measurement

   Not available

4. ☐ If measured clamp current data is available provide an IBIS and Silicon clamp comparison for all models

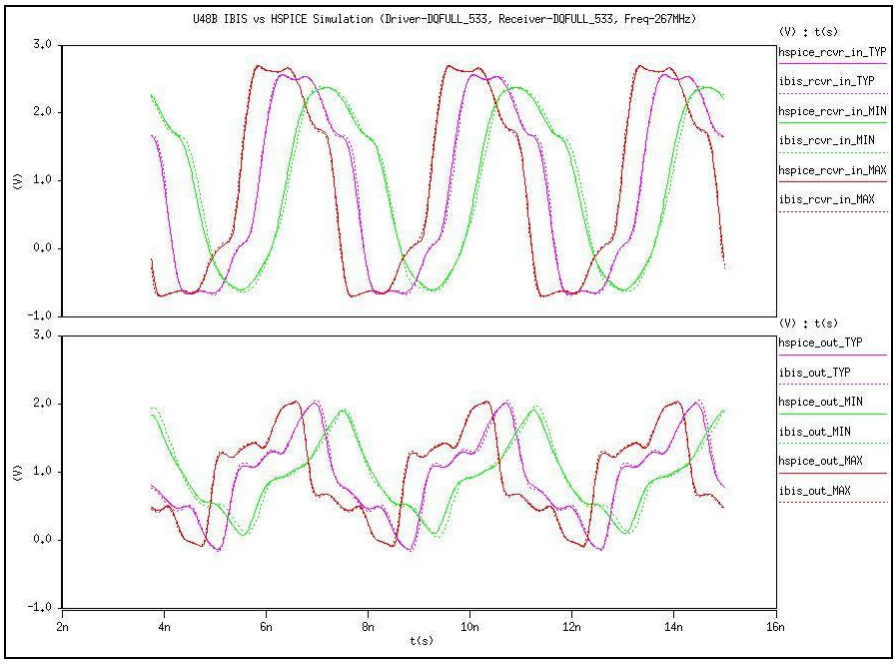
   Not available

IBIS vs HSPICE Correlation

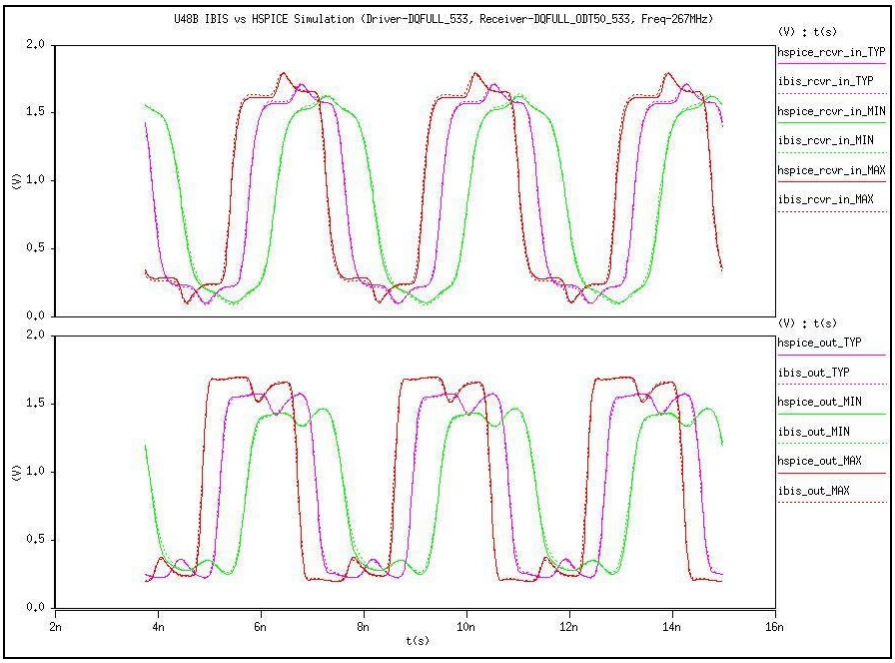
1. ☒ For all output model or I/O model run hspice transient simulation using encrypted netlist and using IBIS model (b-element).
   a. ☒ Use the below setup and node naming conventions for the Ibis and Hspice deck file (.sp file). Indicate and update the setup diagram if it is different. Indicate version of Hspice simulator used for simulation (**Hspice 2006.09**)
   b. ☒ Run simulation for all corners cases

   In the IBIS file typ and slow corner V-t curves in DQ_*_667 models are shifted by -200ps and -500ps relative to strong corner v-t curve to contain all 3 corners within 1.5ns window. Typ and slow corner V-t curves in DQFULL_*_1066 models are shifted by -300ps and -400ps relative to strong corner v-t curve to contain all 3 corners within 0.938ns window. Because of this shift the typ and slow corner input stimulus in IBIS simulation are delayed by the v-t shift time as mentioned above. This does not effect the accuracy of the IBIS data.

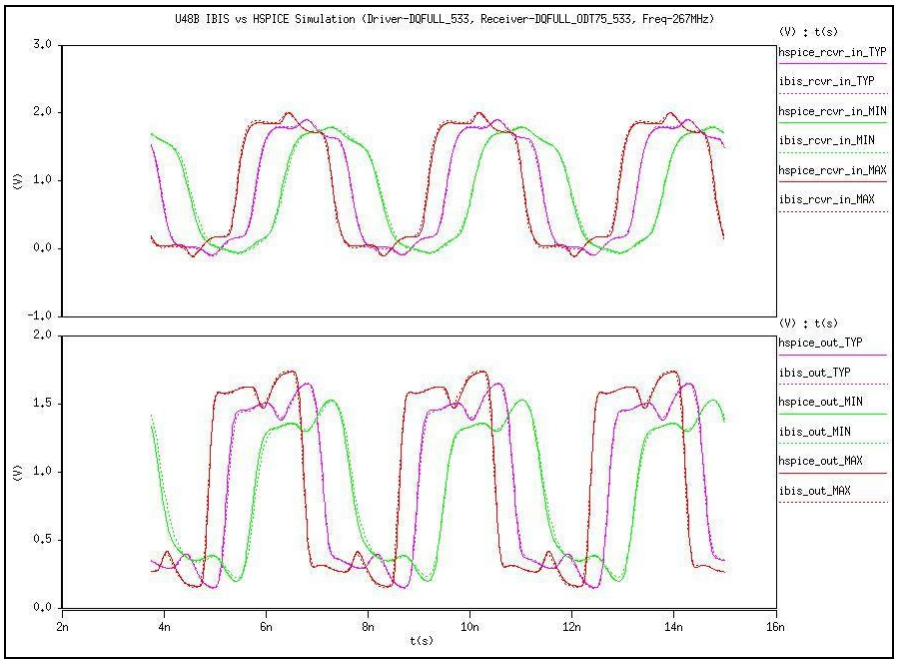
i. DQFULL_533 driving DQFULL_533



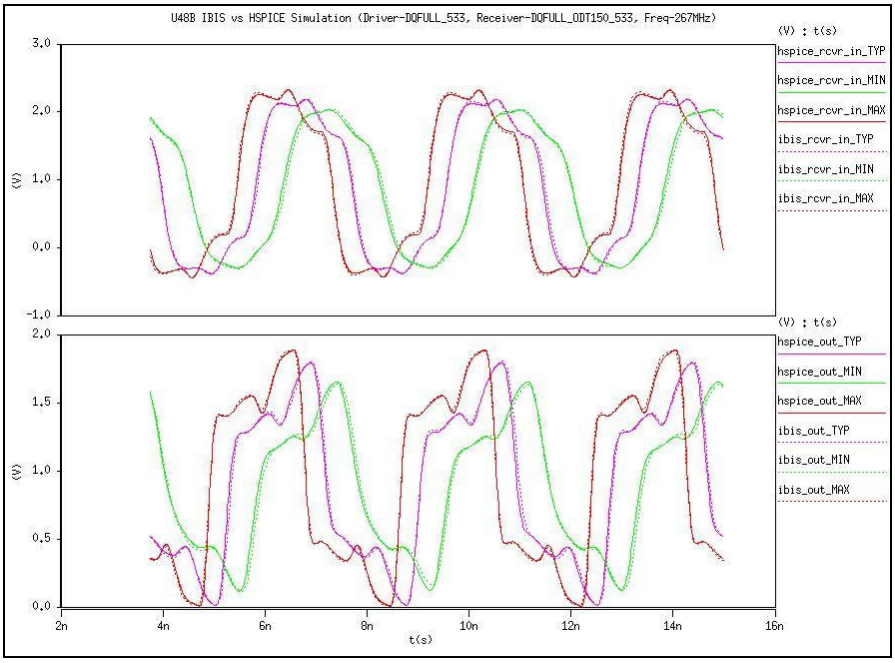
ii. DQFULL_533 driving DQFULL_ODT50_533



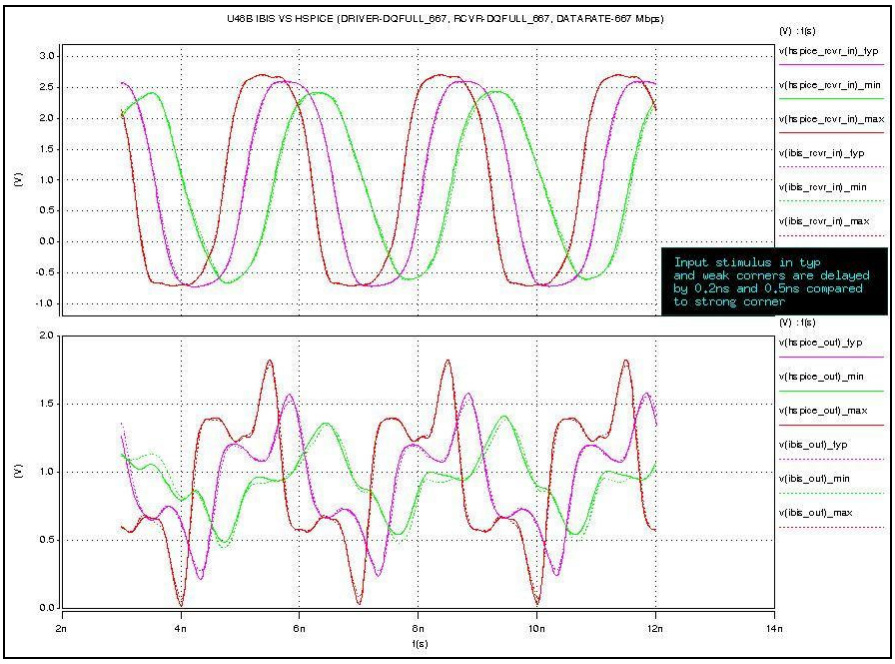
iii. DQFULL_533 driving DQFULL_ODT75_533



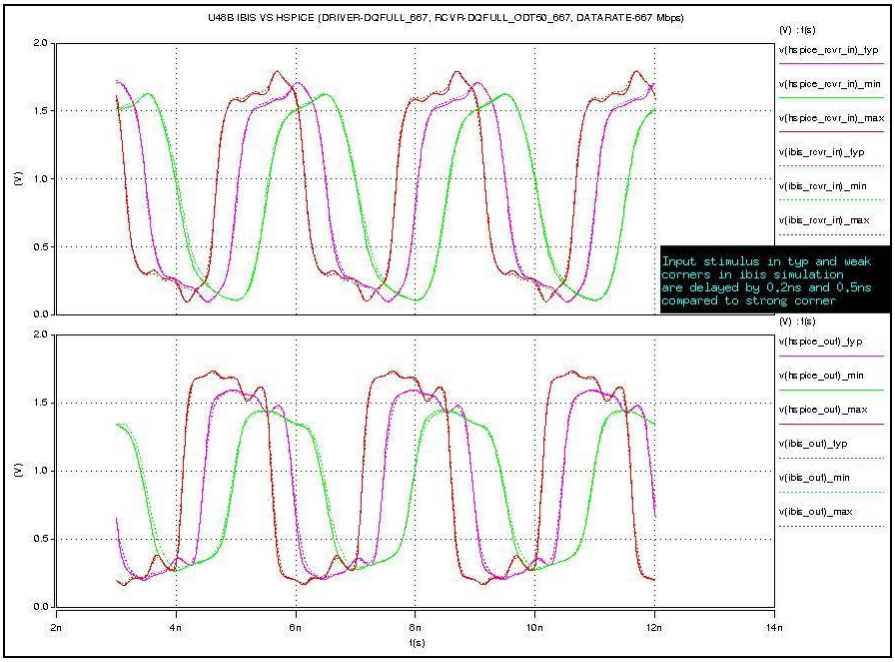
iv. DQFULL_533 driving DQFULL_ODT150_533



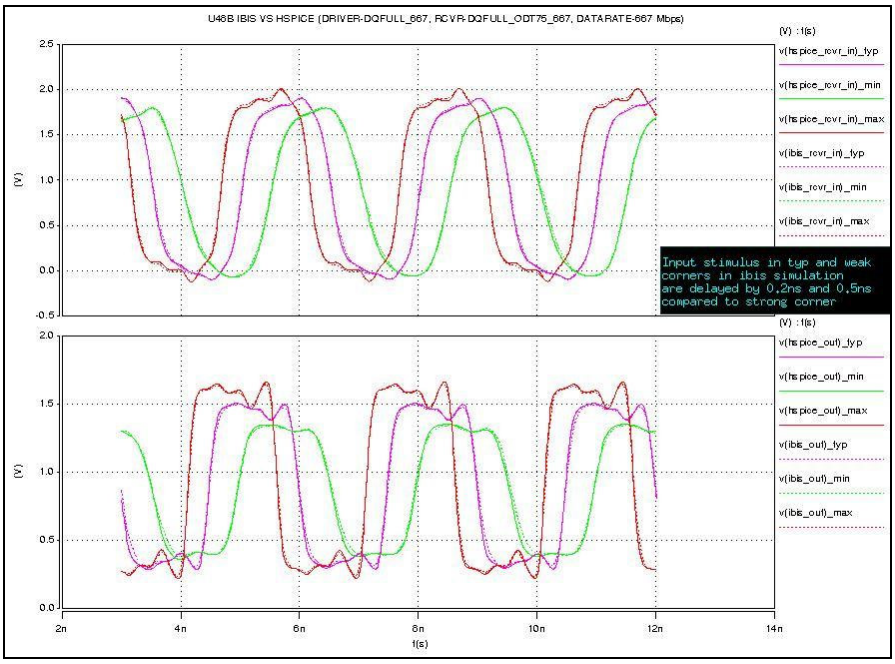
v. DQFULL_667 driving DQFULL_667



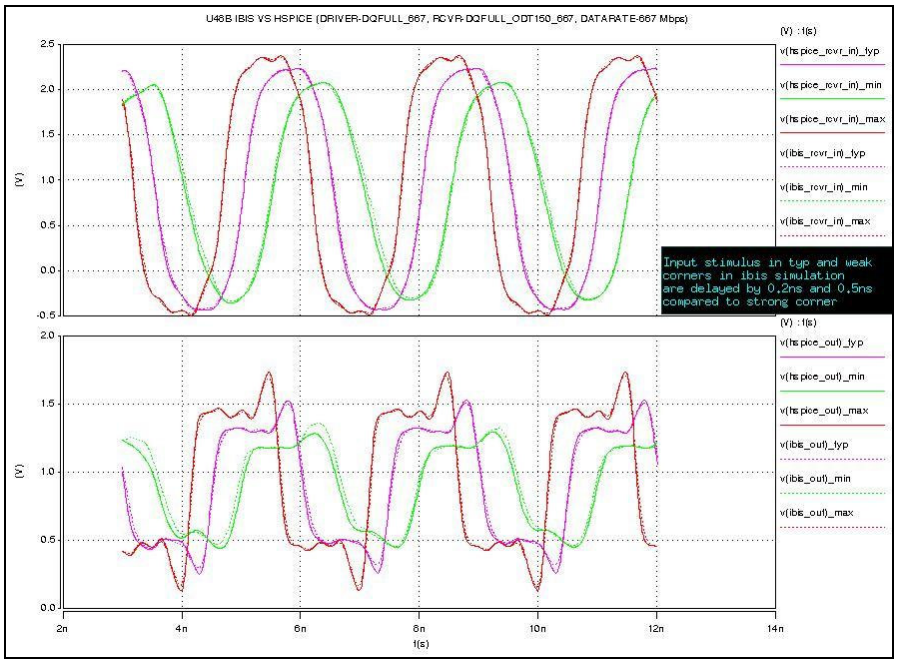
vi. DQFULL_667 driving DQFULL_ODT50_667



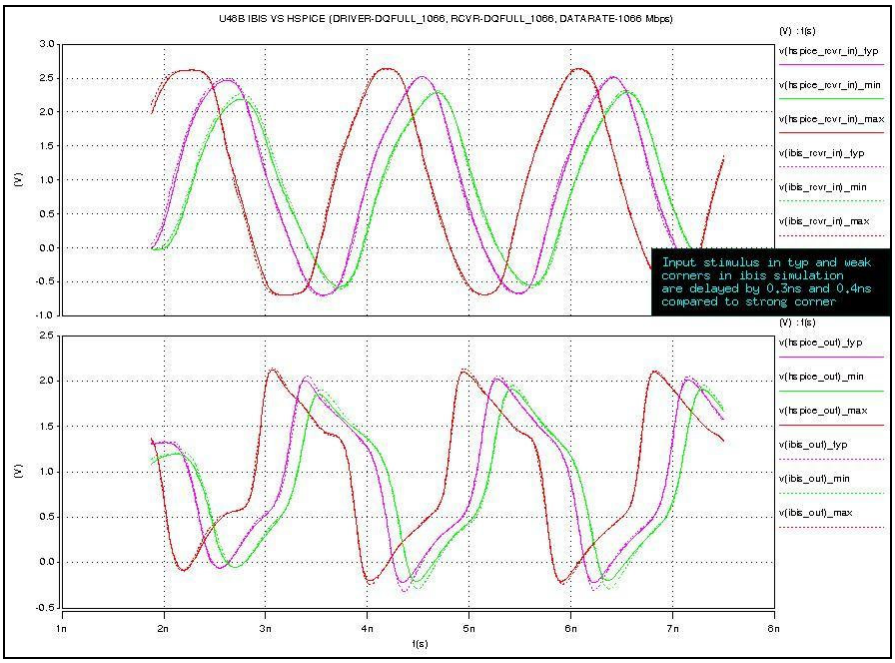
vii. DQFULL_800 driving DQFULL_ODT75_800



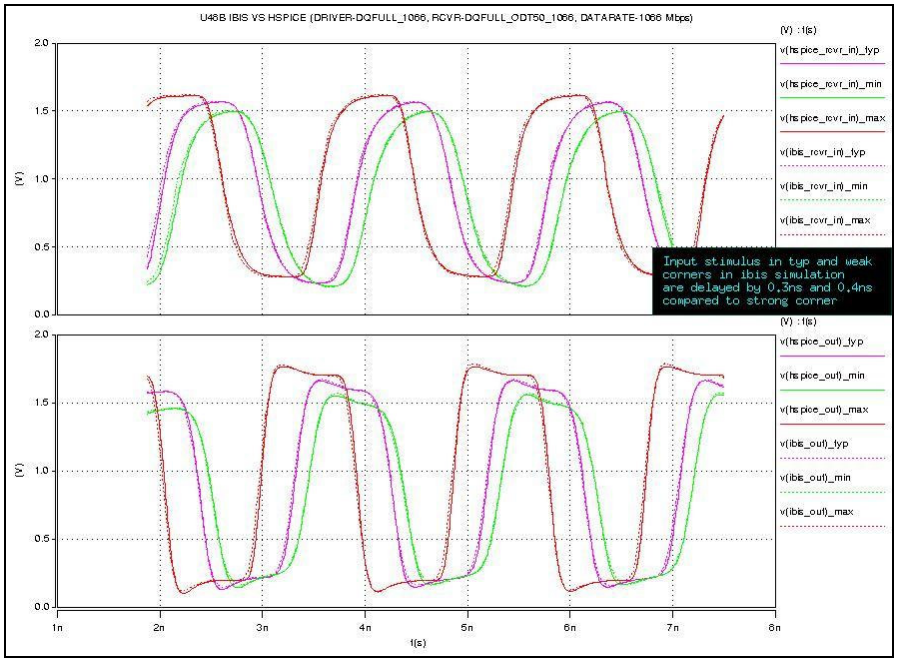
viii. DQFULL_667 driving DQFULL_ODT150_667



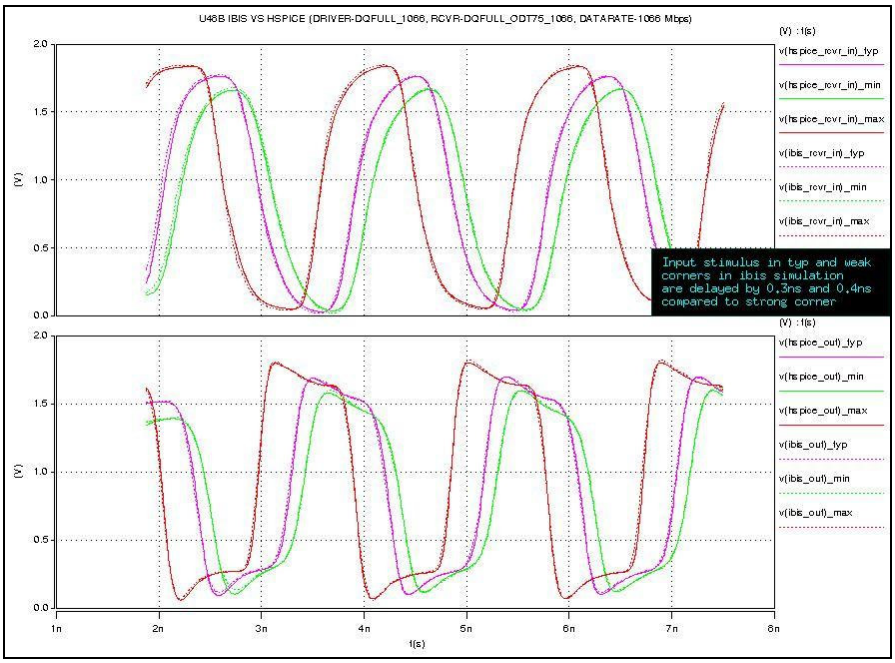
ix. DQFULL_1066 driving DQFULL_1066



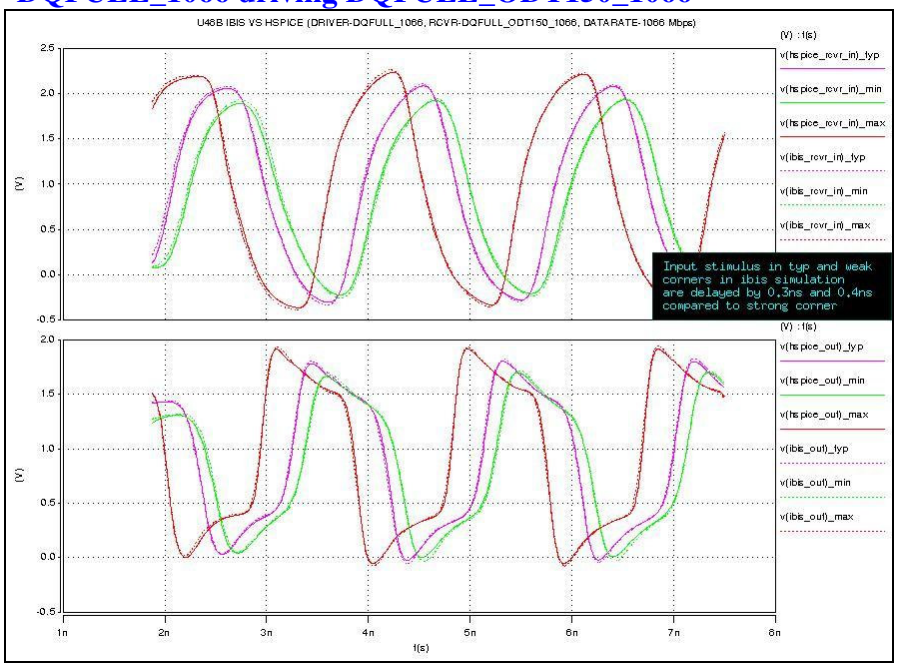
x. DQFULL_1066 driving DQFULL_ODT50_1066



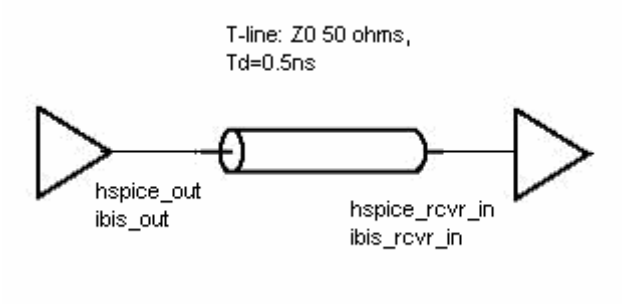
xi. DQFULL_1066 driving DQFULL_ODT75_1066



xii. DQFULL_1066 driving DQFULL_ODT150_1066



Setup



Driver and Receiver models used from u48b.ibs model (Temperature range-commercial)

Simulator- Synopsys Hspice 2006.09

Comments:

Document Revision history

Rev 1.0- 11/14/2006

