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## **IBIS/HSPICE Model Quality Report**

Design ID: **U68A**

Description: **2Gb x4, x8 TwinDie DDR2 SDRAM**

Marketing device name(s): **MT47H512M4THN, MT47H256M8THN**

Valid Speed Grades: **DDR2-400, DDR2-533, DDR2-667, DDR2-800**

Zip File Name: **u68a\_2cob\_ibis.zip**

IBIS Bare Die File Name: **u68a\_bd\_stacked.ibs, u68a\_it\_bd\_stacked.ibs** File rev: **2.4**

HSPICE File Name: **u68a\_2cob\_hspice.zip** File rev: **2.3**

IBIS EBD File Name (if applicable): **u68ax4\_2cob.ebd, u68ax4\_clp\_2cob.ebd, u68ax8\_2cob.ebd, u68ax8\_clp\_2cob.ebd** File rev: **2.1**

Die Rev: **H**

Date: **March 1, 2011**

Datasheet Link:

E-mail at [modelsupport@micron.com](mailto:modelsupport@micron.com) for questions regarding Quality Report

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### **Device Parameters**

VDDQ – Slow: **1.7V** Typical: **1.8V** Fast: **1.9V**

VDD – Slow: **1.7V** Typical: **1.8V** Fast: **1.9V**

Junction Temperature (Commercial) - Slow: **100C** Typical: **50C** Fast: **0C**

Junction Temperature (Industrial) - Slow: **110C** Typical: **50C** Fast: **-40C**

Junction Temperature (Automotive) - Slow: **120C** Typical: **50C** Fast: **-40C**

VDDQ/VSSQ Decoupling Capacitance: **572pF**

Included in HSPICE DQ/DQS models? **Yes** Amount per DQ/DQS model: **28.6pF/57.2pF**

VDDQ/VSSQ Decoupling Capacitance Series Resistance: **0.01ohm**

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### **IBIS Quality Summary**

1. ☒ Include the IBIS Quality Specification 2.0 Overall IBIS Quality level. For details on IBIS Quality, reference the quality specification and quality checklist on IBIS quality webpage [http://www.eda.org/pub/ibis/quality\\_wip/](http://www.eda.org/pub/ibis/quality_wip/).

Overall IBIS Quality Level: **IQ3MSX**

Exceptions: **Overshoot parameters not available from datasheet, Tslew\_ac/Tdiffslew\_ac not available from datasheet set high**

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2. ☒ Include the filename of the IBIS Quality Checklist that accompanies this report.

Filename: [u68a\\_2cob\\_ibis\\_quality\\_checklist.xls](#)

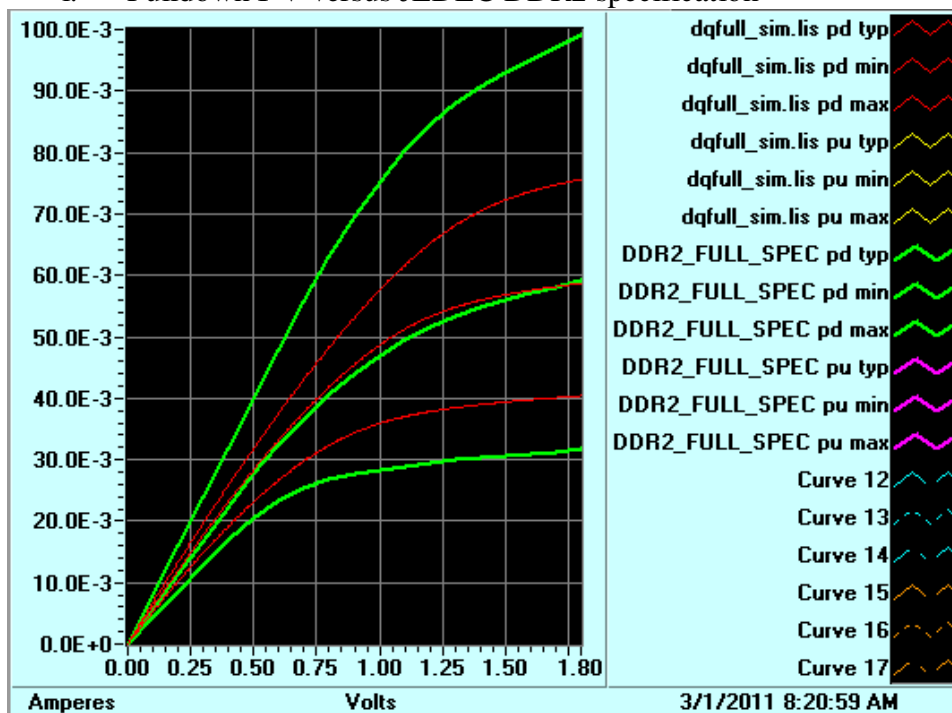
### **IBIS MODEL Correlation**

#### **Datasheet Correlation**

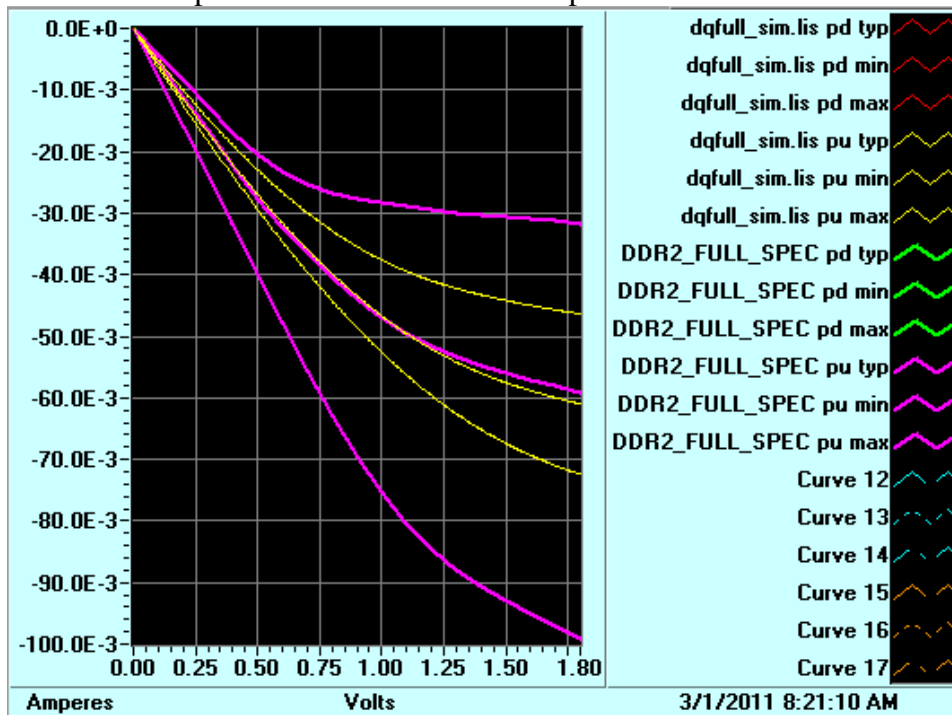
1. ☒ For Output or I/O model compare datasheet IOH/IOL data with IBIS pullup/pulldown data.<sup>2</sup>

a. Model name: **DQ\_FULL\_533**

i. Pulldown I-V versus JEDEC DDR2 specification

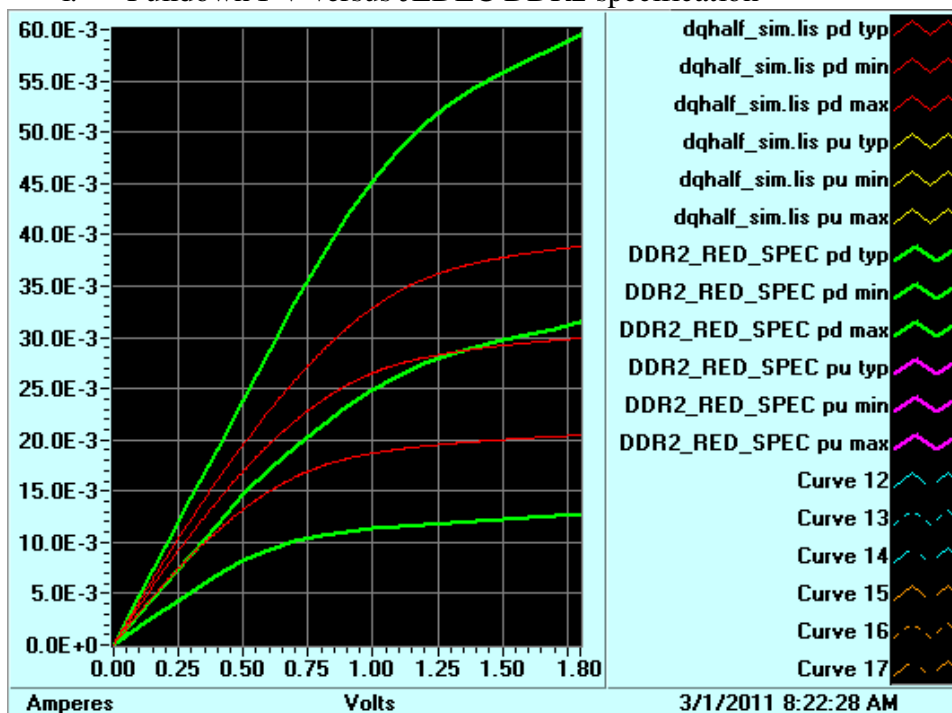


ii. Pullup I-V versus JEDEC DDR2 specification

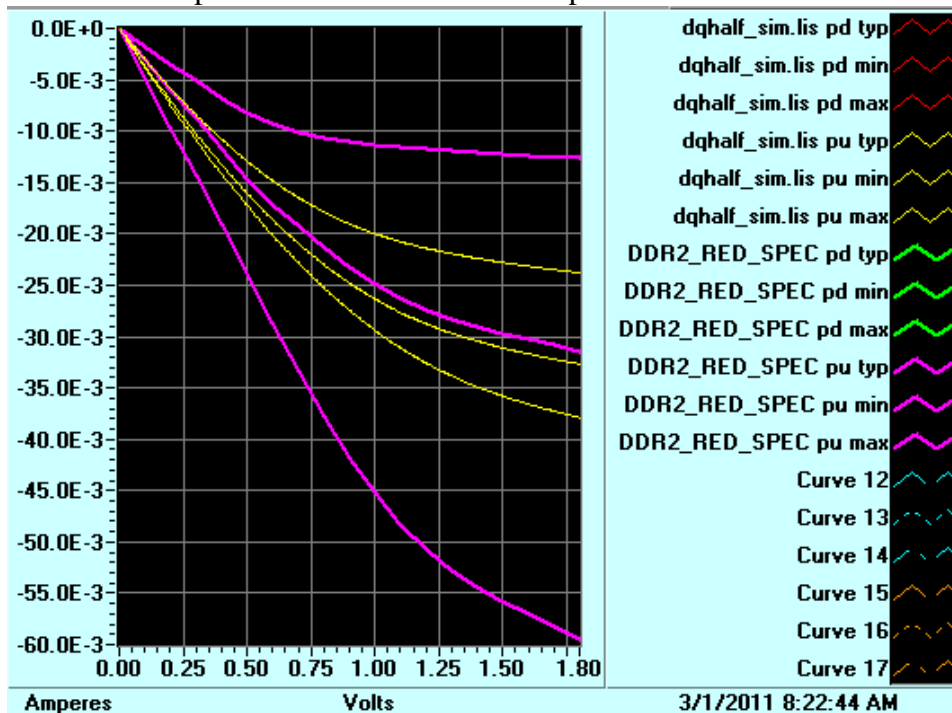


b. Model name: **DQ\_HALF\_533**

i. Pulldown I-V versus JEDEC DDR2 specification



ii. Pullup I-V versus JEDEC DDR2 specification



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 **MT47H256M8THN**

		IBIS		Datasheet	
		min	max	min	max
<b>DQ/DQS</b>	C_comp	4.632	5.232	NA	NA
	C_package	1.606	2.123	NA	NA
	C_total	6.238	7.355	5.50	10.50
<b>ADDR/ CMD</b>	C_comp	1.966	2.366	NA	NA
	C_package	1.482	1.885	NA	NA
	C_total	3.448	4.251	3.25	7.50
<b>CK/CK#</b>	C_comp	1.976	2.376	NA	NA
	C_package	1.792	1.808	NA	NA
	C_total	3.768	4.184	3.50	7.50
<b>CTRL</b>	C_comp	0.988	1.188	NA	NA
	C_package	1.280	1.651	NA	NA
	C_total	2.268	2.839	1.75	3.50

3. ☒ If slew rate specifications (rise/fall slew) are available from the datasheet, complete HSpice simulations to generate slew rate data and provide a comparison table. <sup>1</sup>

		IBIS			Datasheet	
Model	Slew Rate (V/ns)	min	typ	max	min	max
<b>DQ Full</b>	Rising	1.703	3.061	4.796	1.500	5.000
	Falling	2.094	3.435	5.229	1.500	5.000
<b>DQ Half</b>	Rising	0.971	1.753	2.897	1.500	5.000
	Falling	1.071	1.940	3.264	1.500	5.000

☒ Compare ODT data with datasheet. <sup>2</sup>

ODT calculated using the formula  $RTT = (V_{IH(ac)} - V_{IL(ac)}) / (I(V_{IH(ac)}) - I(V_{IL(ac)}))$

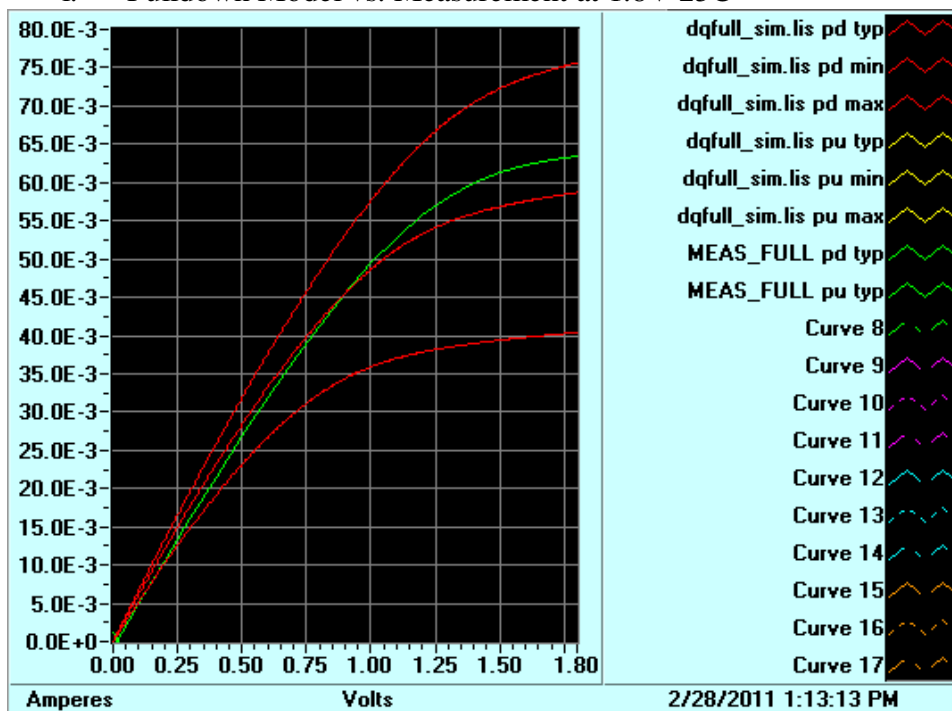
ODT50	TYP	SLOW	FAST
Vil (V)	0.65	0.60	0.70
Vih (V)	1.15	1.10	1.20
Ivil (A)	-4.71E-03	-4.66E-03	-5.86E-03
Ivih (A)	5.10E-03	4.81E-03	4.59E-03
	TYP	SLOW	FAST
Rtt (Model)	50.98	52.77	47.85
Rtt (datasheet)	50	60	40
ODT75	TYP	SLOW	FAST
Vil (V)	0.65	0.60	0.70
Vih (V)	1.15	1.10	1.20
Ivil (A)	-3.14E-03	-3.11E-03	-3.91E-03
Ivih (A)	3.40E-03	3.21E-03	3.06E-03
	TYP	SLOW	FAST
Rtt (Model)	76.47	79.16	71.77
Rtt (datasheet)	75	90	60
ODT150	TYP	SLOW	FAST
Vil (V)	0.65	0.60	0.70
Vih (V)	1.15	1.10	1.20
Ivil (A)	-1.57E-03	-1.55E-03	-1.95E-03
Ivih (A)	1.70E-03	1.60E-03	1.53E-03
	TYP	SLOW	FAST
Rtt (Model)	152.96	158.34	143.55
Rtt (datasheet)	150	180	120

## Measurement Correlation

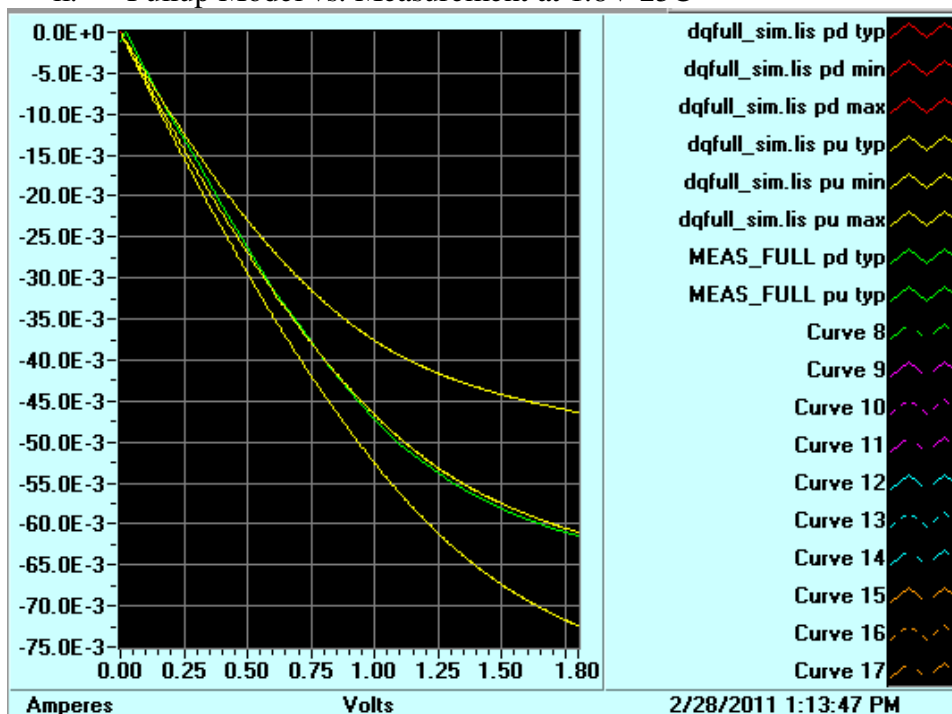
- ☒ For Output or I/O models compare measured IOH/IOL data with IBIS pullup/pulldown data. If the measurement conditions are different than the IBIS conditions, run HSpice simulations using the same measurement conditions such as VCC, temperature, and process. Include measurement conditions in the pullup/pulldown images. <sup>2,3</sup>

a. Model name: **DQ\_FULL\_533**

i. Pulldown Model vs. Measurement at 1.8V 25C



ii. Pullup Model vs. Measurement at 1.8V 25C



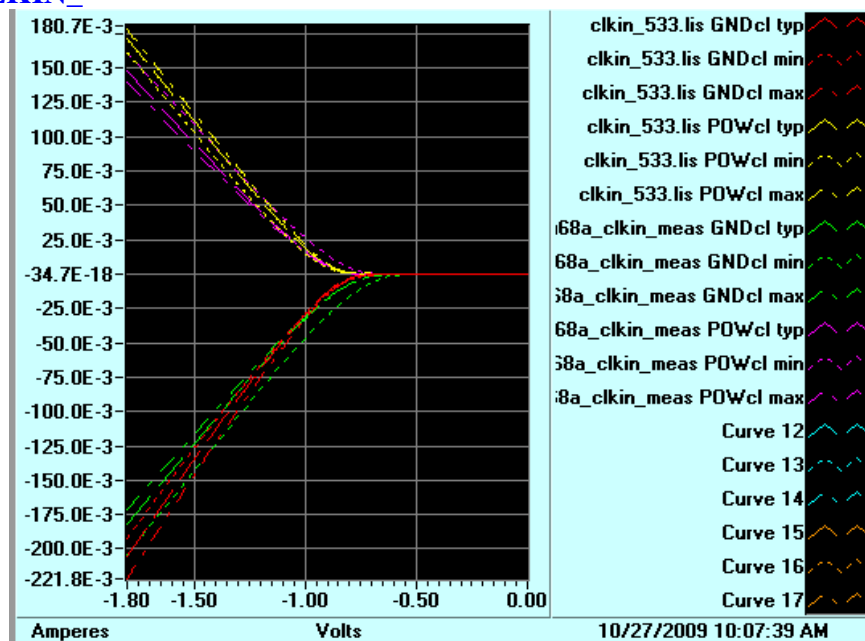
2. ☒ Compare C\_comp with measured C\_comp. Provide C\_comp comparison table for all models and for all package combinations (i.e x4, x8 and x16).

Insert component name here **MT47H256M8THN**

		IBIS			Measurement		
		min	typ	max	min	typ	max
<b>DQ/DQS</b>	C_comp	4.632	4.932	5.232	NA	NA	NA
	C package	1.606	1.844	2.123	NA	NA	NA
	C_total	6.238	6.776	7.355	6.454	6.660	6.838
<b>ADDR/ CMD</b>	C_comp	1.966	2.166	2.366	NA	NA	NA
	C package	1.482	1.673	1.885	NA	NA	NA
	C_total	3.448	3.839	4.251	3.601	3.812	4.024
<b>CK/CK#</b>	C_comp	1.976	2.176	2.376	NA	NA	NA
	C package	1.792	1.800	1.808	NA	NA	NA
	C_total	3.768	3.976	4.184	3.878	3.941	4.015
<b>CTRL</b>	C_comp	0.988	1.088	1.188	NA	NA	NA
	C package	1.280	1.419	1.651	NA	NA	NA
	C_total	2.268	2.507	2.839	2.261	2.417	2.589

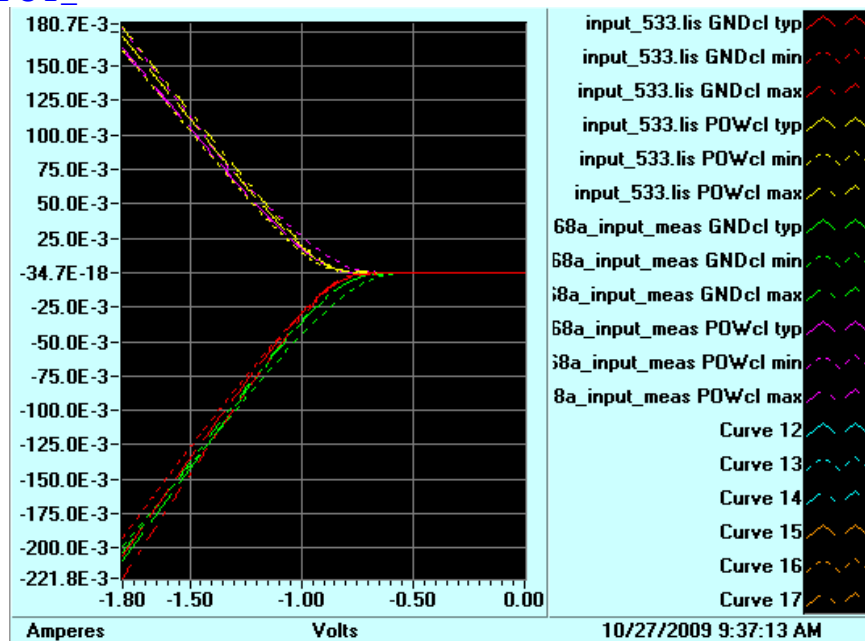
3. ☒ If measured clamp current data is available provide an IBIS and measurement comparison for all models.

a. **CLKIN\_\***

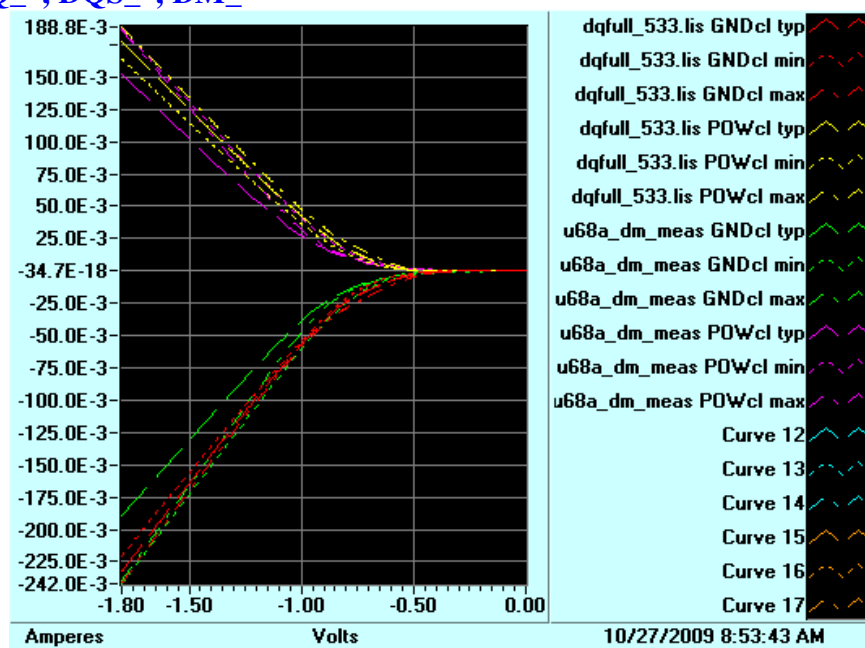




b. **INPUT\_\***



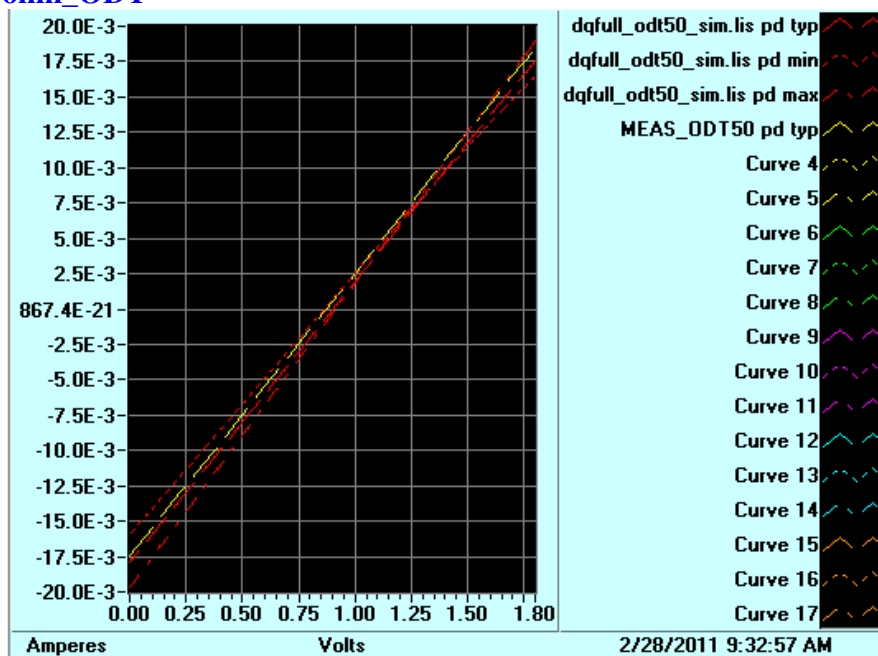
c. **DQ\_\*, DQS\_\*, DM\_\***



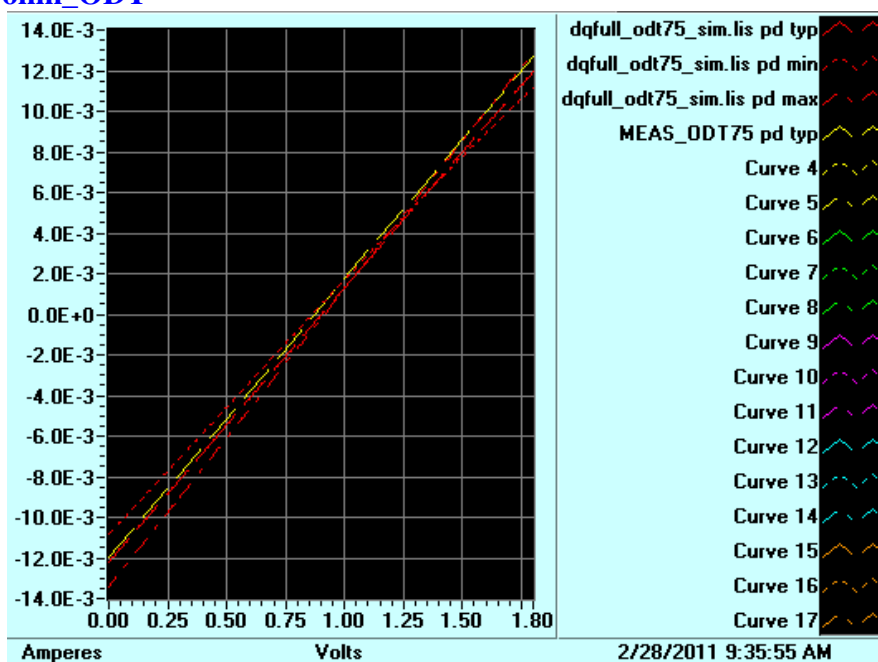
4. ☒ If slew rate data (rise/fall slew) is available from measurements, complete HSpice simulations to generate slew rate data and provide a comparison table.

5. ☒ Compare ODT data with measurements. <sup>2,3</sup>

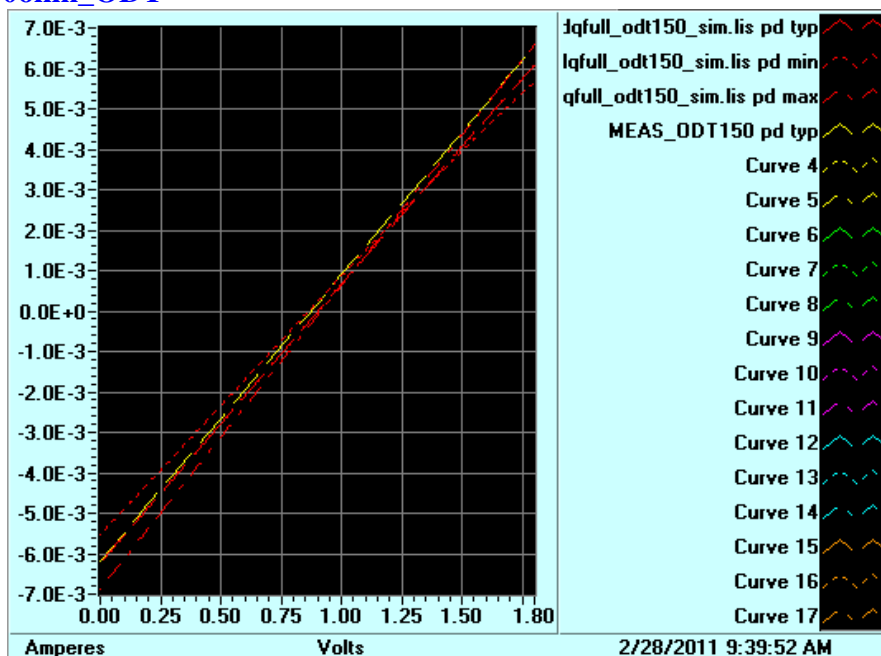
a. **50ohm\_ODT**



b. **75ohm\_ODT**



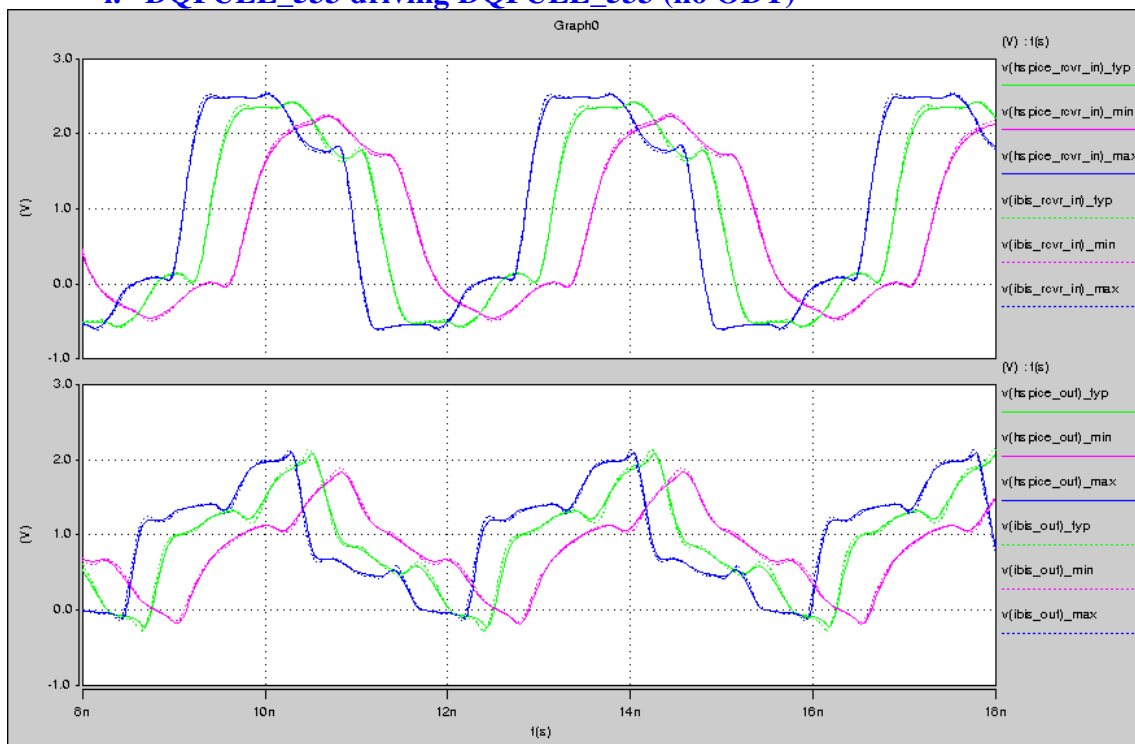
c. 150ohm\_ODT



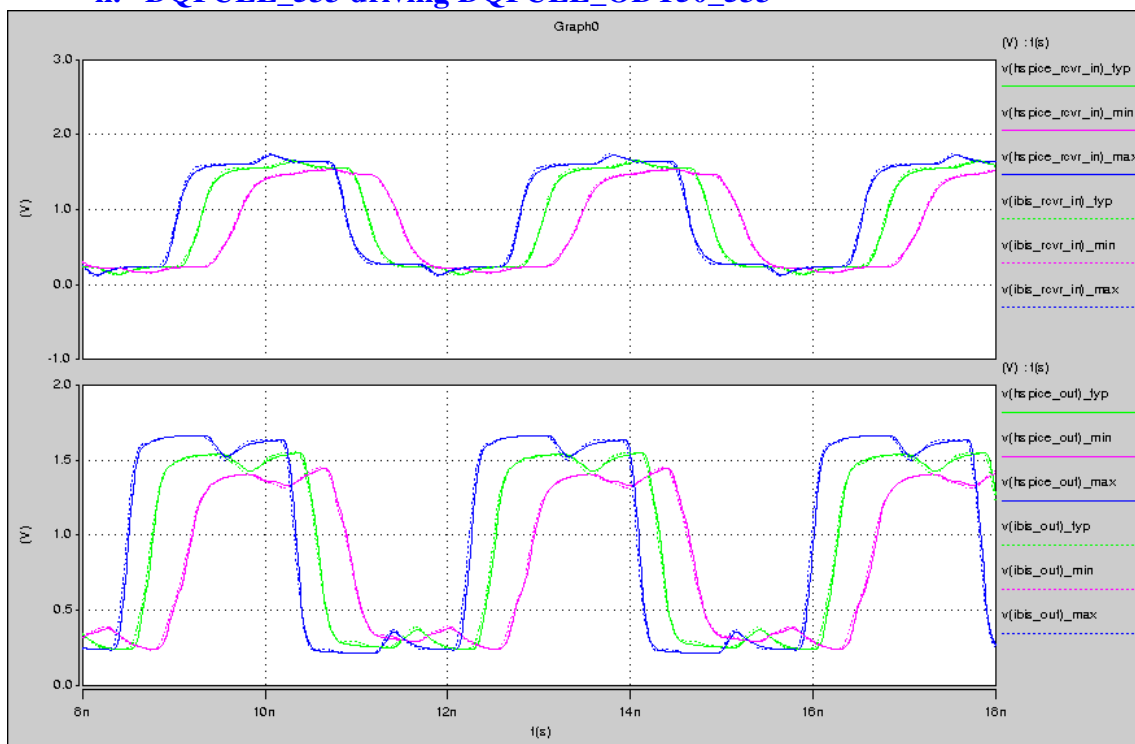
**IBIS vs HSPICE Correlation**

1. ☒ For all Output or I/O models, run HSpice transient simulations using encrypted netlists and the IBIS model (b-element).
  - a. ☒ Use the setup and node naming conventions shown below for the IBIS and HSpice deck file (.sp file). Update the setup diagram if it is different. Indicate the version of HSPICE simulator used for simulations: **HSPICE: 2008.09**
  - b. ☒ Run simulations for all corners cases and at maximum allowable speed grade

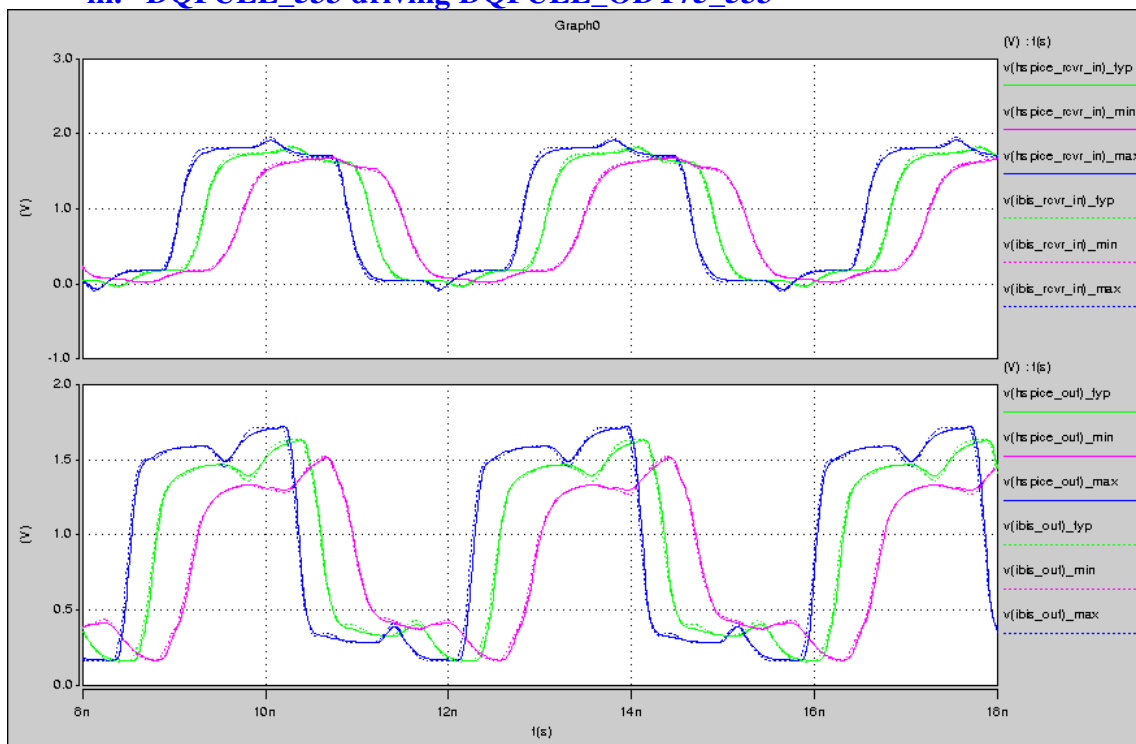
### i. DQFULL\_533 driving DQFULL\_533 (no ODT)



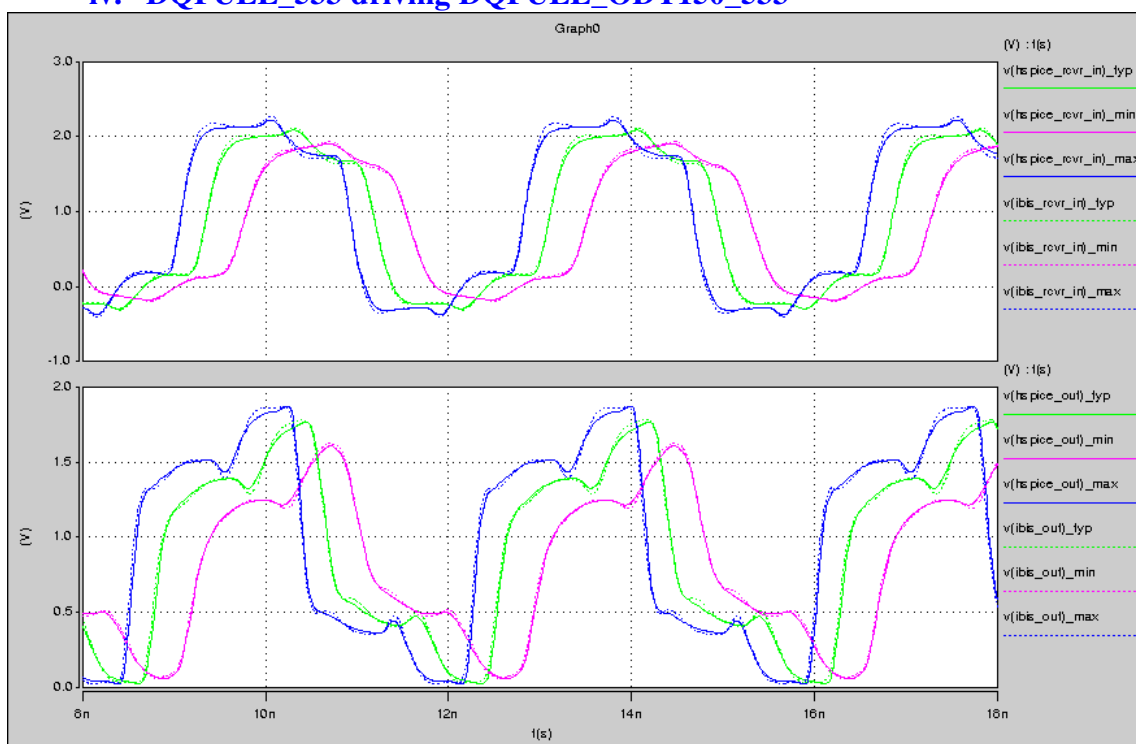
### ii. DQFULL\_533 driving DQFULL\_ODT50\_533



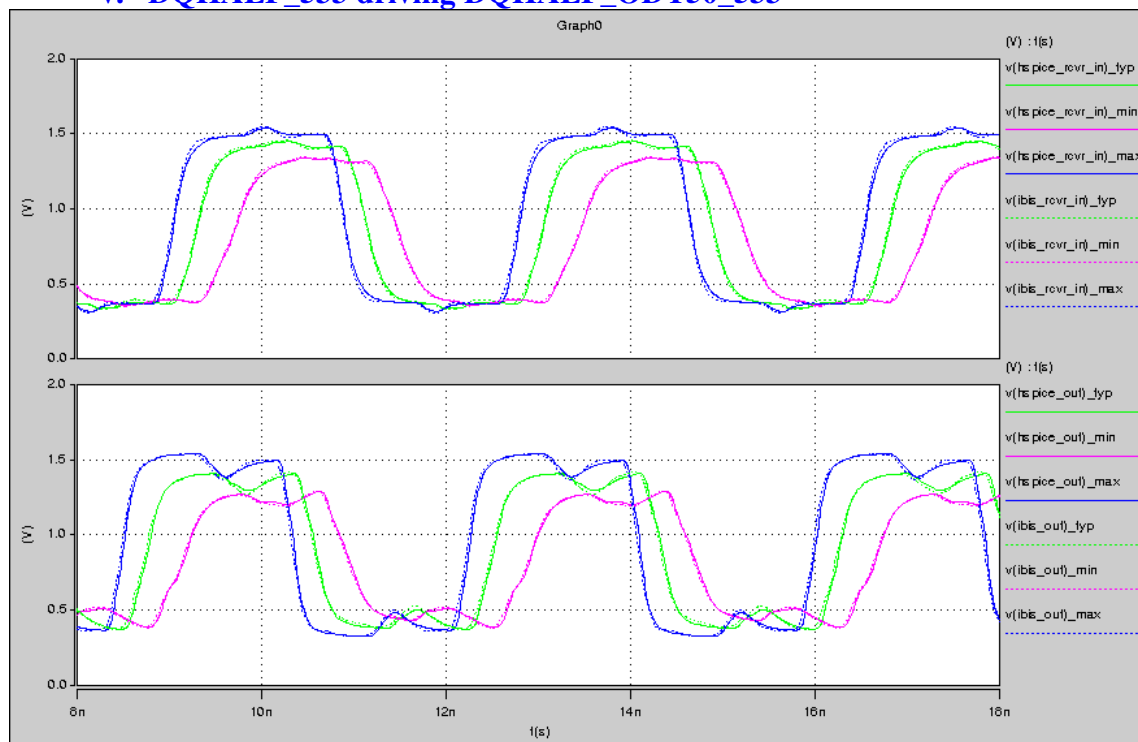
### iii. DQFULL\_533 driving DQFULL\_ODT75\_533



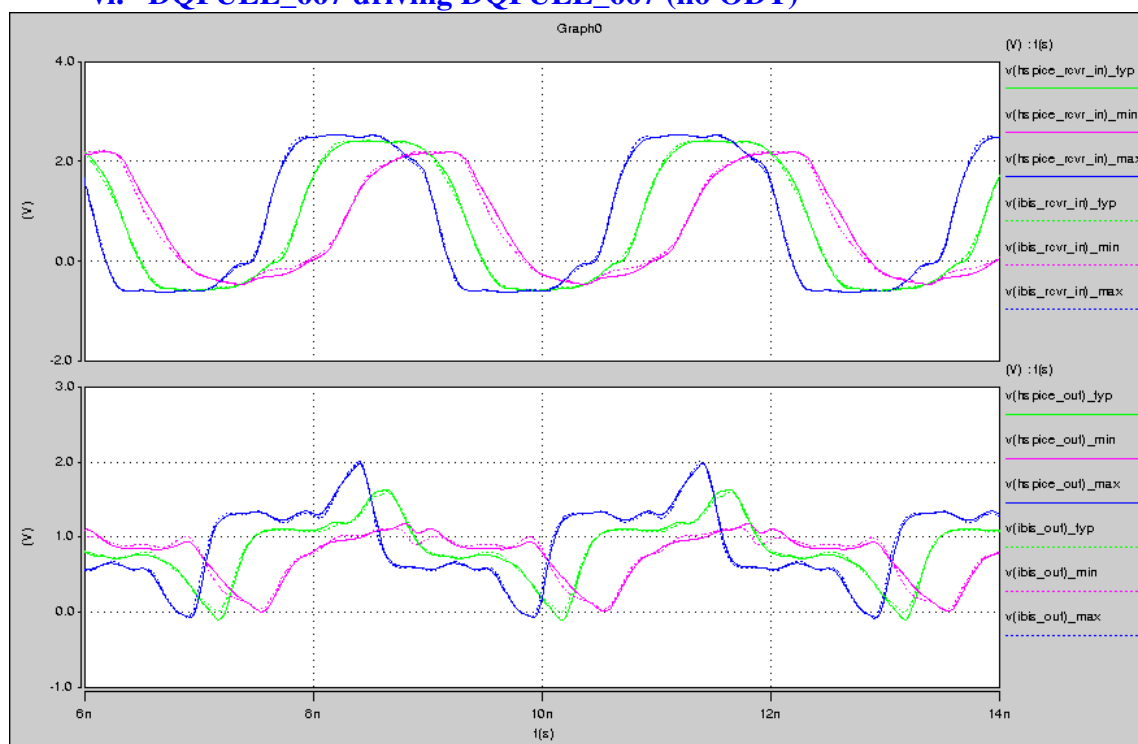
### iv. DQFULL\_533 driving DQFULL\_ODT150\_533



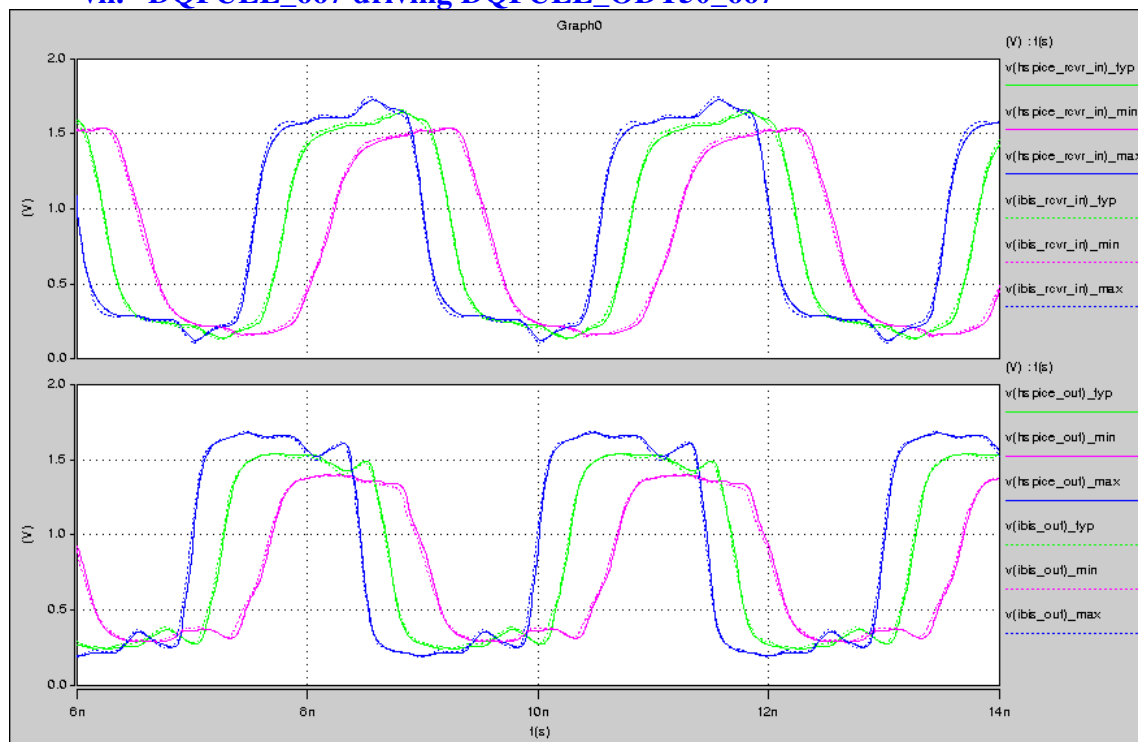
#### v. DQHALF\_533 driving DQHALF\_ODT50\_533



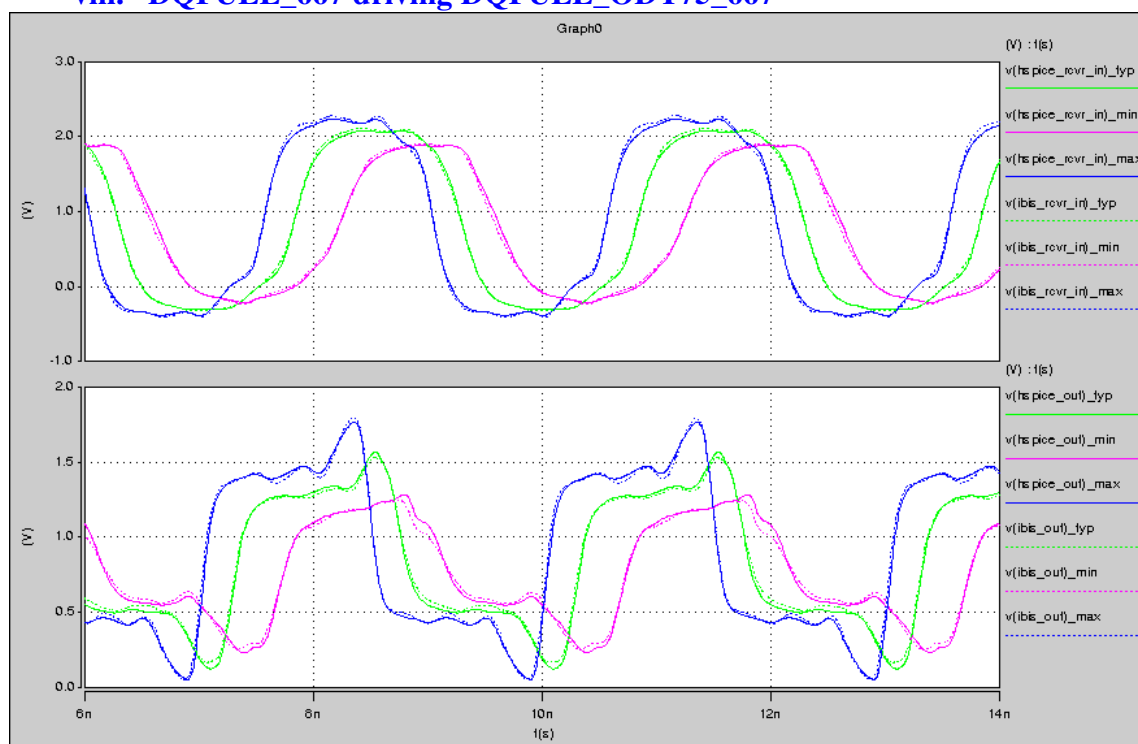
#### vi. DQFULL\_667 driving DQFULL\_667 (no ODT)



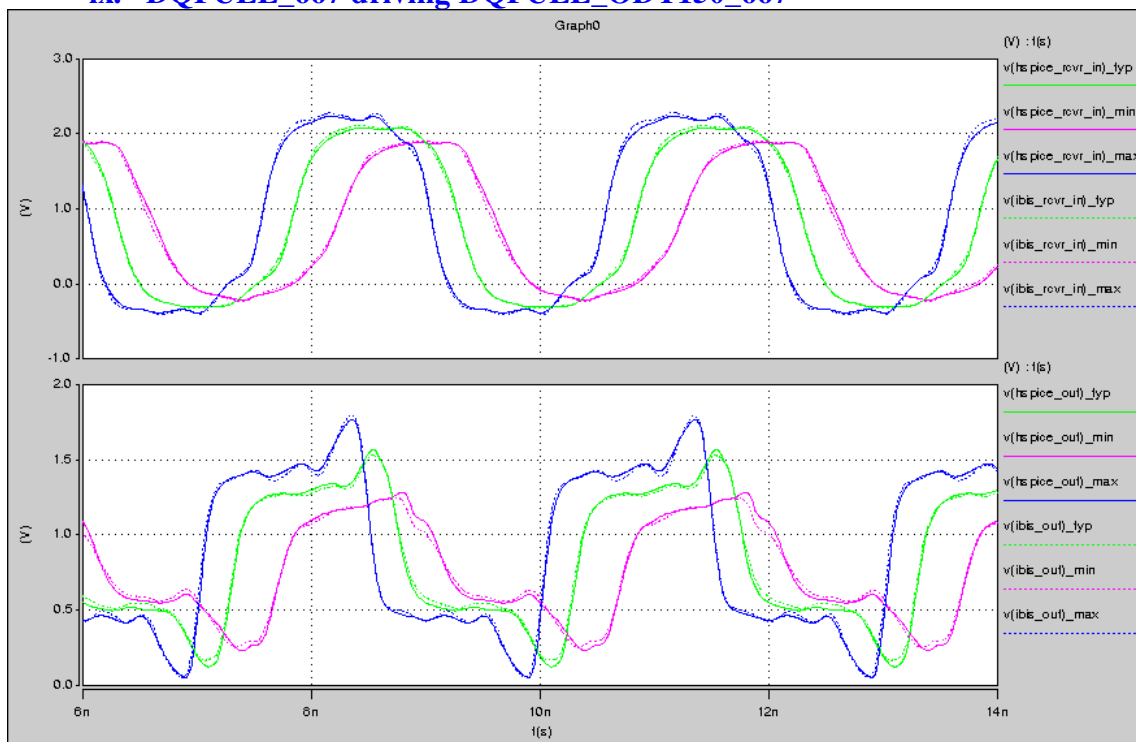
### vii. DQFULL\_667 driving DQFULL\_ODT50\_667



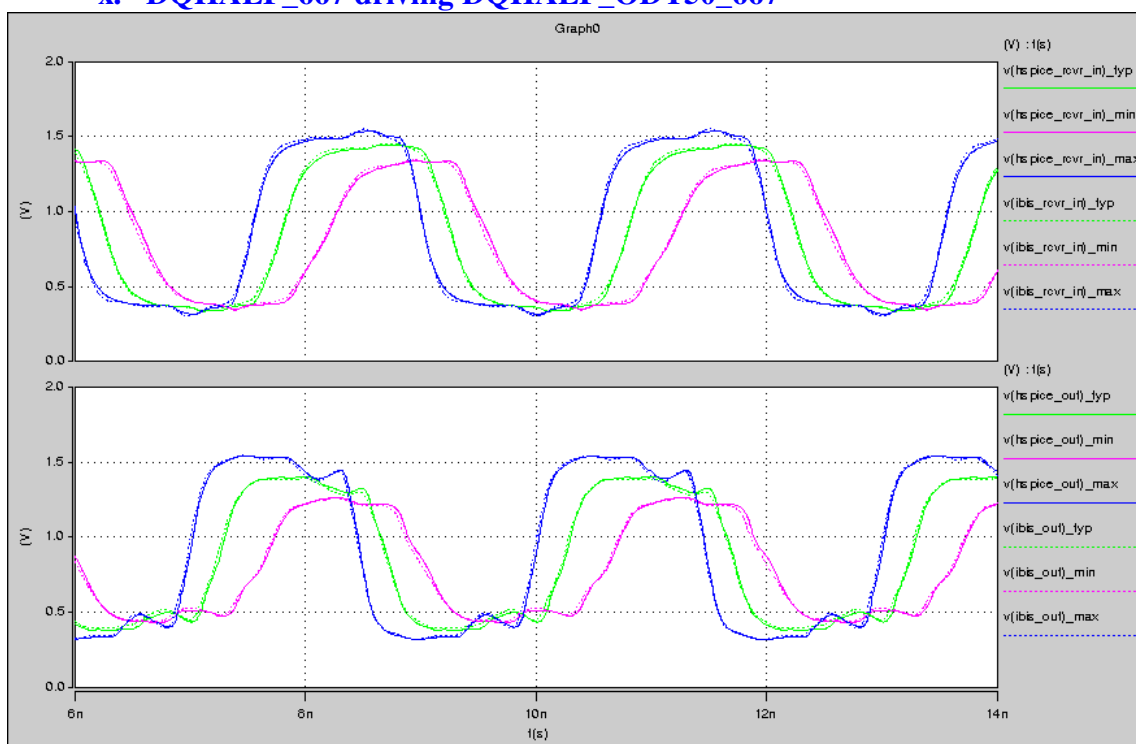
### viii. DQFULL\_667 driving DQFULL\_ODT75\_667



### ix. DQFULL\_667 driving DQFULL\_ODT150\_667

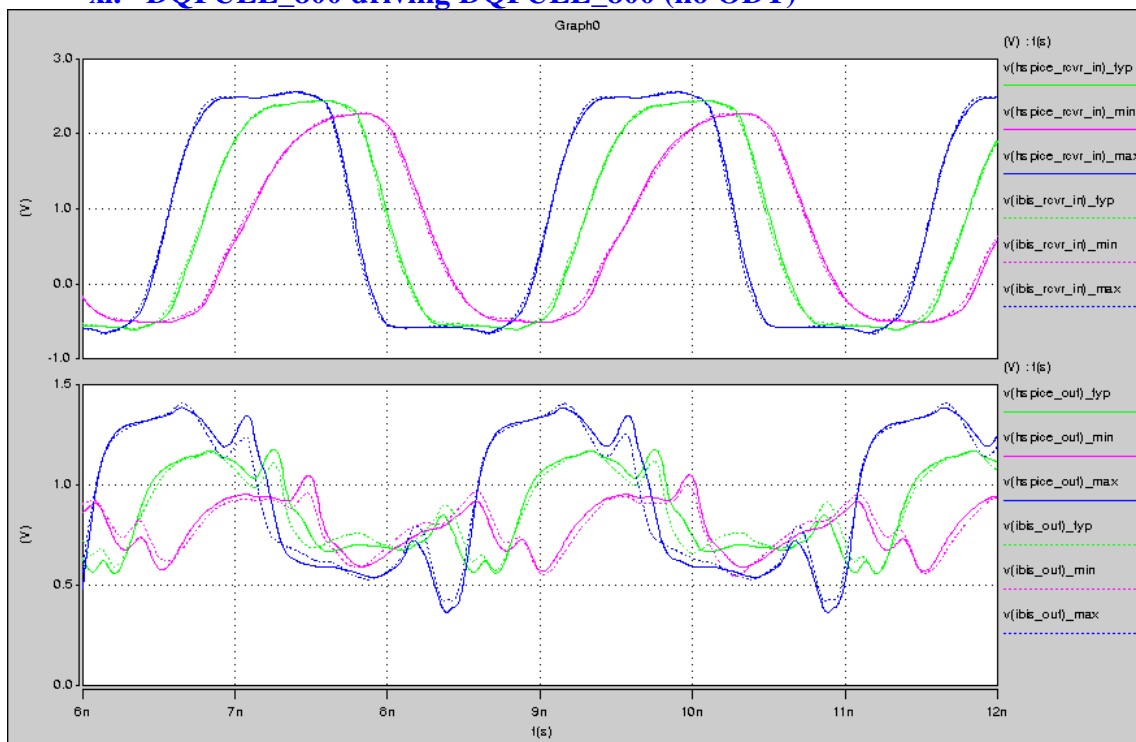


### x. DQHALF\_667 driving DQHALF\_ODT50\_667

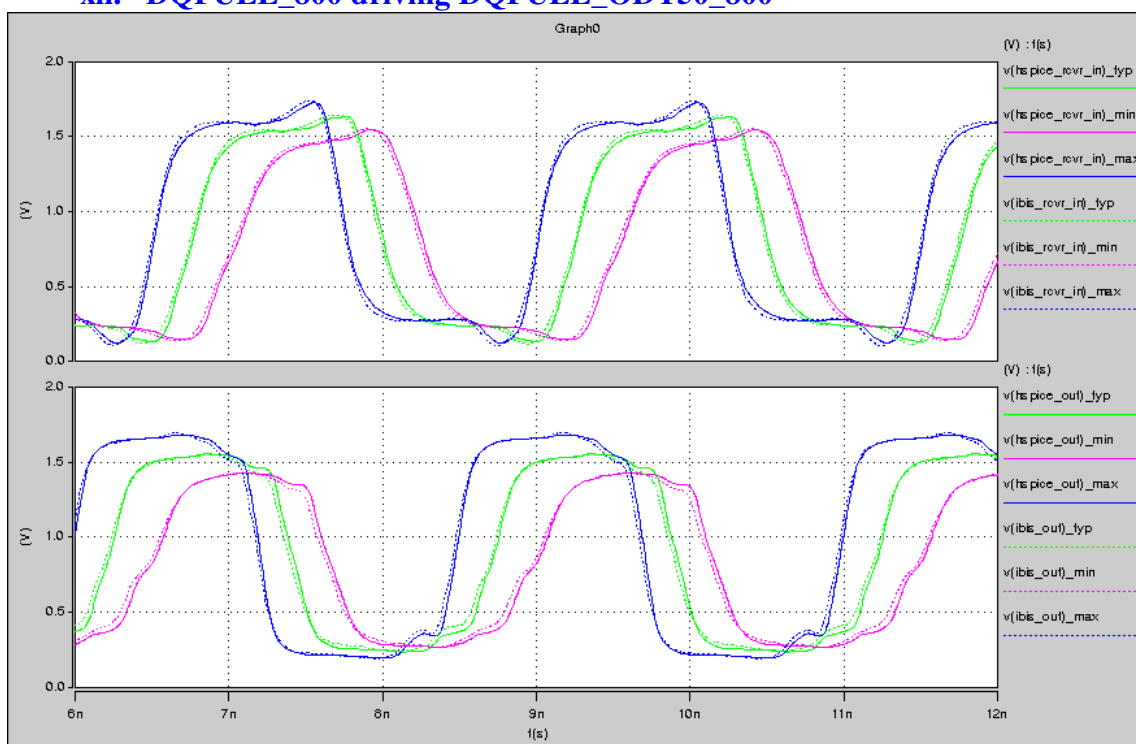




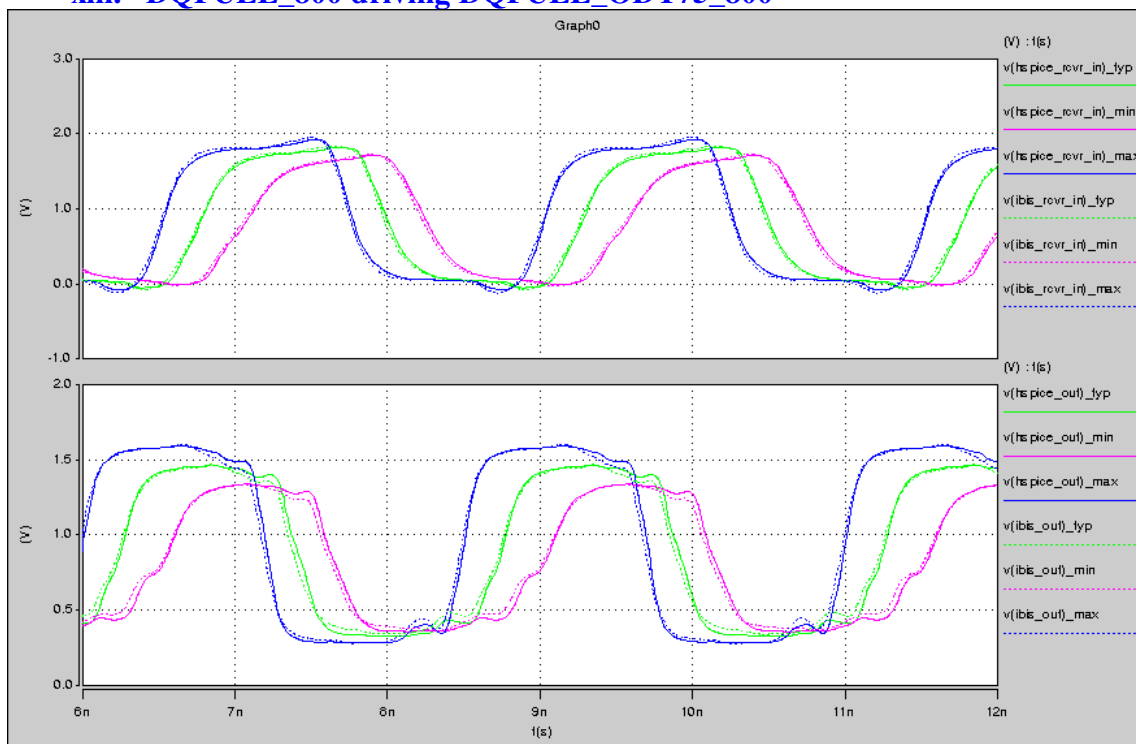
### xi. DQFULL\_800 driving DQFULL\_800 (no ODT)



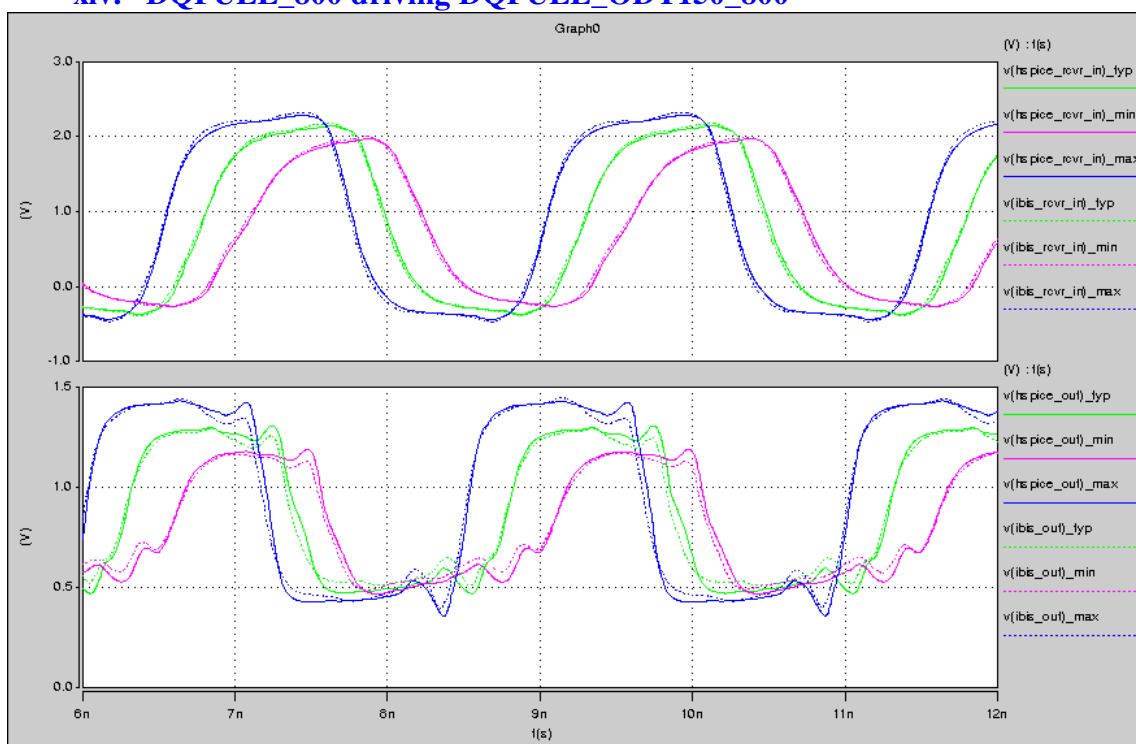
### xii. DQFULL\_800 driving DQFULL\_ODT50\_800



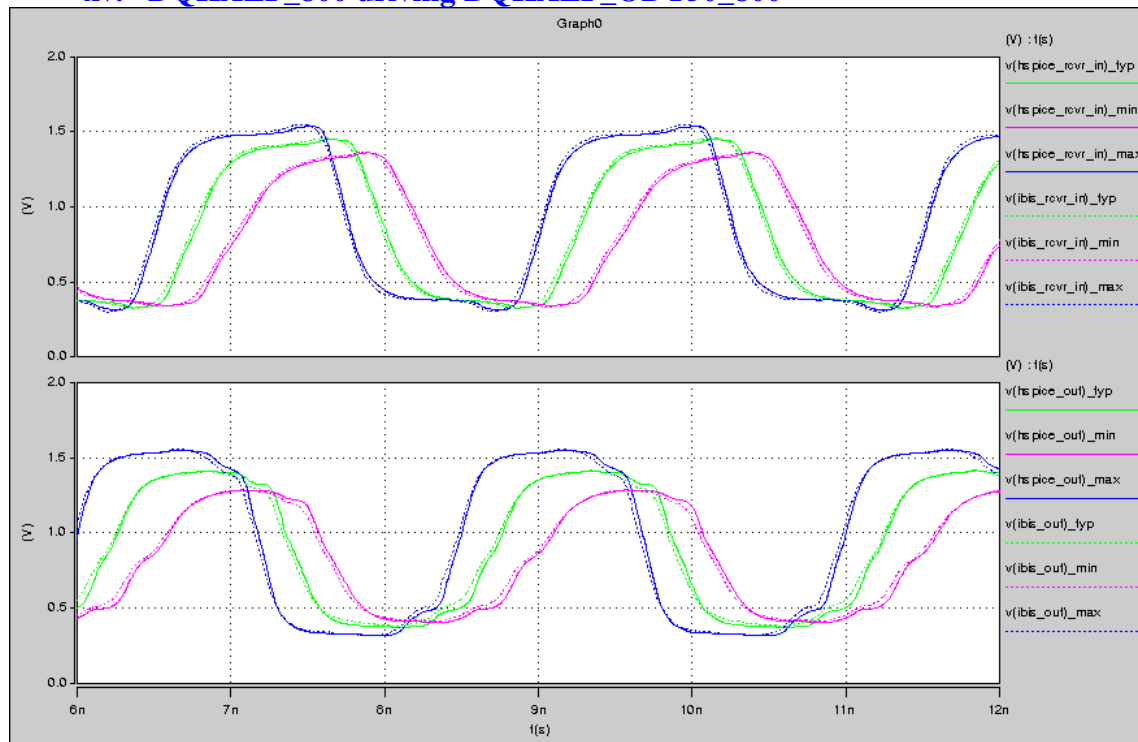
### xiii. DQFULL\_800 driving DQFULL\_ODT75\_800



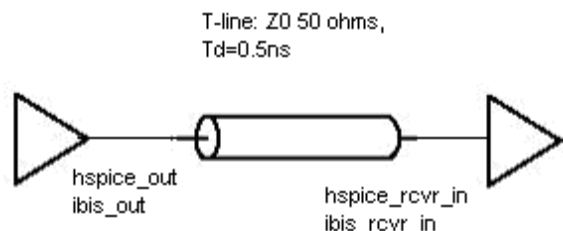
### xiv. DQFULL\_800 driving DQFULL\_ODT150\_800



### xv. DQHALF\_800 driving DQHALF\_ODT50\_800



### Setup



### Comments:

1. Slew rate is based on HSPICE simulation with a 25ohm to Vtt load. This includes simple package parasitics.
2. The effect of the series resistance from the stacked package model (.ebd) is included in the IBIS pullup and pulldown data that is compared to the datasheet and measured IOH/IOL. This resistance is also included in the IBIS ODT values that are compared to the datasheet and measurements.
3. The Full drive strength measured I-V curves are taken at Typ = 1.8V, 25C.

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## **Document Revision History**

### Rev **1.0** – **2/26/2010**

- a. IBIS EBD revision **2.1**
- b. HSPICE revision **2.1**

### Rev **1.1** – **3/01/2011**

- a. IBIS EBD revision **2.1**
- b. IBIS Bare Die revision **2.4**
- c. HSPICE revision **2.3**