
IBIS/HSPICE Model Quality Report

Design ID: **V68A**

Description: **1Gb 1.35V DDR3L SDRAM**

Marketing device name(s): **MT41K256M4JP, MT41K128M8JP, MT41K64M16JT, MT41K256M4V68A, MT41K128M8V68A, MT41K64M16V68A**

Valid speed grades: **DDR3L-800, DDR3L-1066, DDR3L-1333, DDR3L-1600¹**

Zip filename: **v68a_1p35_ibis.zip**

IBIS filename: **v68a_1p35.ibs, v68a_1p35_it.ibs²** File rev: **2.2**

HSpice filename: **v68a_1p35_hspice.zip** File rev: **2.1**

EBD filename (if applicable): File rev:

Die rev: **G**

Date: **November 26, 2014**

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

Device Parameters

VDDQ – Slow: **1.283V** Typical: **1.350V** Fast: **1.425V**

VDD – Slow: **1.283V** Typical: **1.350V** Fast: **1.425V**

Junction Temperature (Commercial) - Slow: **110C** Typical: **50C** Fast: **0C**

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

VDDQ/VSSQ Decoupling Capacitance: **11.9nF**

Included in HSPICE DQ/DQS models? **Yes** Amount per DQ/DQS model: **593pF/1186pF**

VDDQ/VSSQ Decoupling Capacitance Series Resistance: **1ohm**

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/.

Overall IBIS Quality Level: **IQ3MS**

Exceptions: **N/A**

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

Filename: [v68a_1p35_ibis_quality_checklist.xls](#)

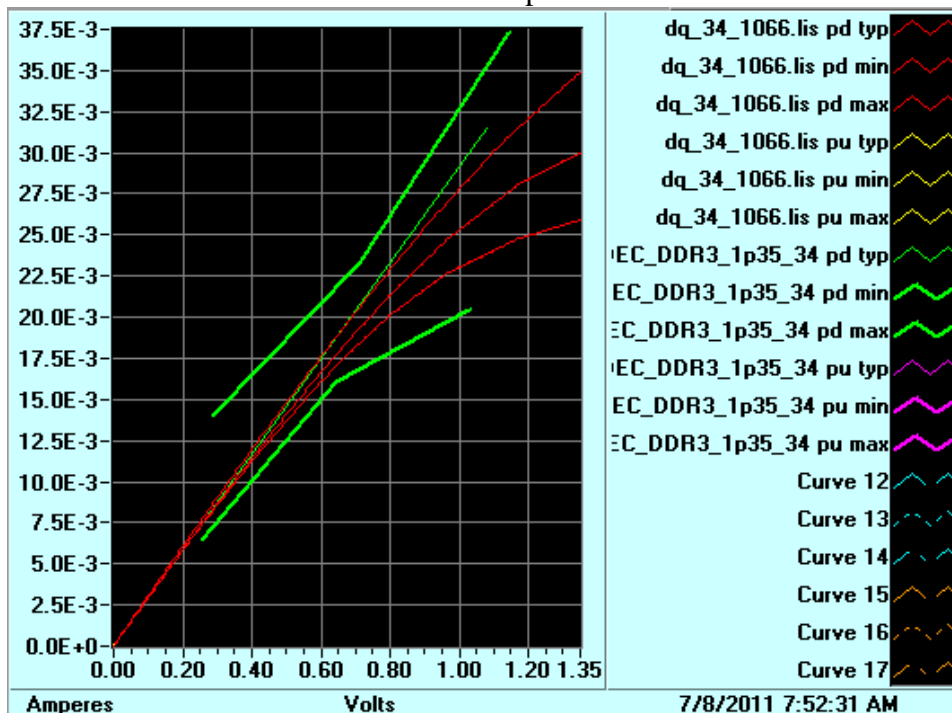
IBIS MODEL Correlation

Datasheet Correlation

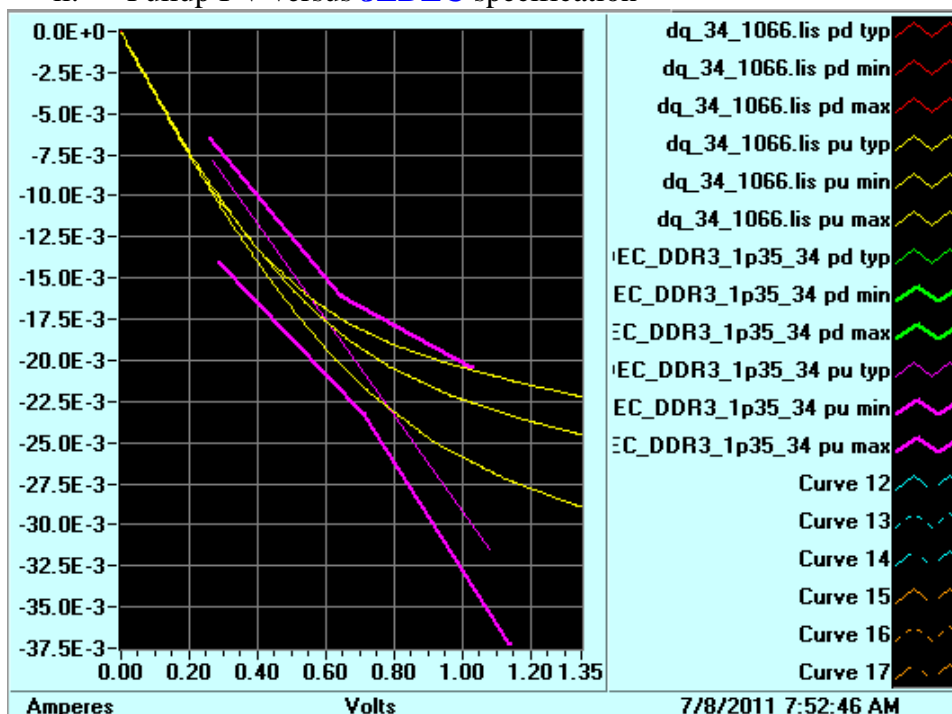
1. ☒ For Output or I/O model compare datasheet IOH/IOL data with IBIS pullup/pulldown data.

a. Model name: **DQ_34_1066**

i. Pulldown I-V versus **JEDEC** specification

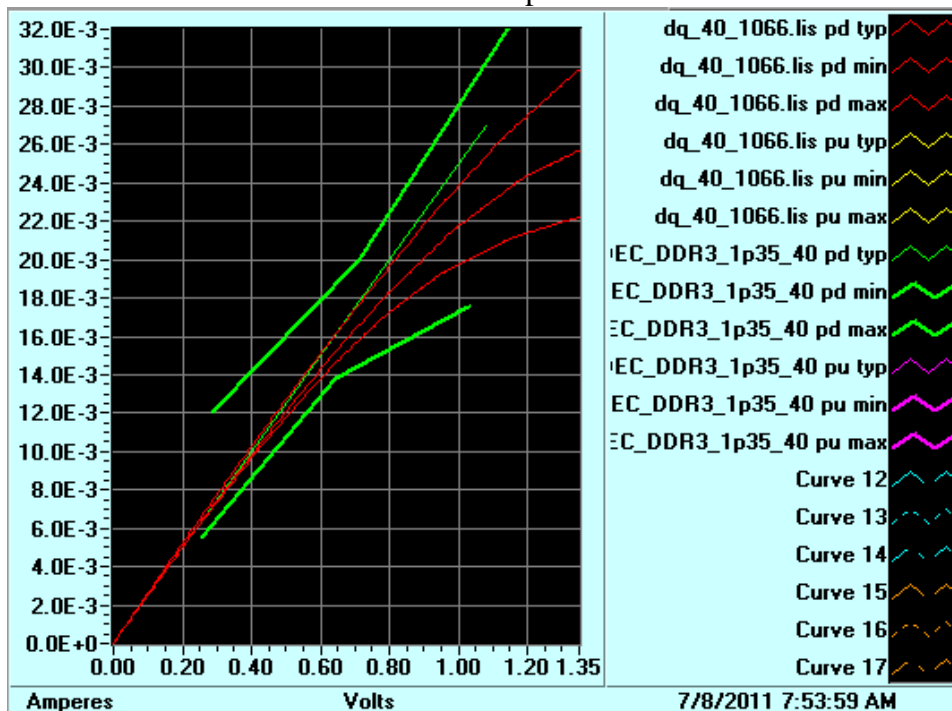


ii. Pullup I-V versus **JEDEC** specification

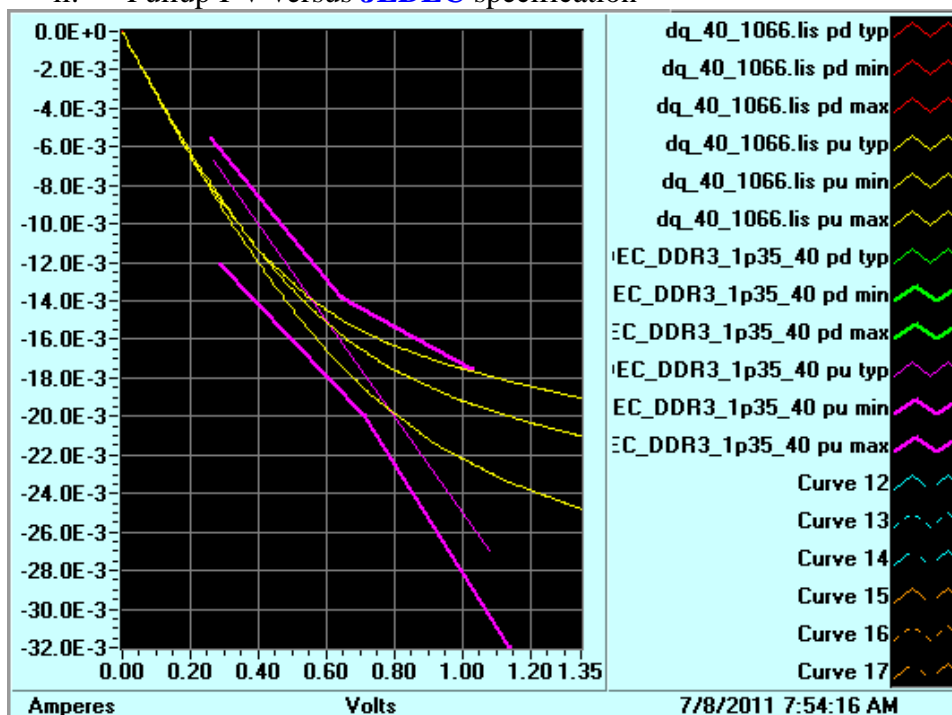


b. Model name: **DQ_40_1066**

i. Pulldown I-V versus **JEDEC** specification



ii. Pullup I-V versus **JEDEC** 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).³

Component name: **MT41K256M4JP, MT41K128M8JP (78-Ball x4/x8)**

		IBIS (pF)		Datasheet (pF)	
		min	max	min	max
DQ	C_comp	1.26	1.46	NA	NA
	C package	0.35	0.54	NA	NA
	C_total	1.61	2.00	1.50	2.30
INPUT	C_comp	0.52	0.72	NA	NA
	C package	0.29	0.56	NA	NA
	C_total	0.81	1.28	0.75	1.30
CLK	C_comp	0.56	0.76	NA	NA
	C package	0.30	0.31	NA	NA
	C_total	0.86	1.07	0.80	1.40

Component name: **MT41K64M16JT (96-Ball x16)**

		IBIS (pF)		Datasheet (pF)	
		min	max	min	max
DQ	C_comp	1.26	1.46	NA	NA
	C package	0.32	0.56	NA	NA
	C_total	1.58	2.02	1.50	2.30
INPUT	C_comp	0.52	0.72	NA	NA
	C package	0.29	0.57	NA	NA
	C_total	0.81	1.29	0.75	1.30
CLK	C_comp	0.56	0.76	NA	NA
	C package	0.31	0.33	NA	NA
	C_total	0.87	1.09	0.80	1.40

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.⁴

Model	Slew Rate (V/ns)	IBIS			Datasheet	
		min	typ	max	min	max
DQ_34_1066	Rising	2.65	3.60	4.68	1.75	6.00
	Falling	2.75	3.91	5.34	1.75	6.00
DQ_40_1066	Rising	2.40	3.85	5.20	1.75	6.00
	Falling	2.80	4.01	5.79	1.75	6.00
DQ_34_1333	Rising	2.65	3.60	4.68	1.75	6.00
	Falling	2.75	3.91	5.34	1.75	6.00
DQ_40_1333	Rising	2.40	3.85	5.20	1.75	6.00
	Falling	2.80	4.01	5.79	1.75	6.00
DQ_34_1600	Rising	2.83	3.60	4.68	1.75	6.00
	Falling	3.06	3.91	5.34	1.75	6.00
DQ_40_1600	Rising	2.95	3.85	5.20	1.75	6.00
	Falling	3.05	4.01	5.79	1.75	6.00

4. ☒ Compare ODT data with datasheet.

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

ODT20	TYP	MIN	MAX
Vil (V)	0.515	0.4815	0.565
Vih (V)	0.835	0.8015	0.885
Ivil (A)	-5.37E-03	-4.96E-03	-6.26E-03
Ivih (A)	6.63E-03	4.91E-03	7.46E-03
	TYP	MAX	MIN
Rtt (Model)	26.67	32.43	23.32
Rtt (datasheet-in units of ZQ/12)	1.0	1.65	0.9
Rtt (datasheet)	20	33	18

ODT30	TYP	MIN	MAX
Vil (V)	0.515	0.4815	0.565
Vih (V)	0.835	0.8015	0.885
Ivil (A)	-3.57E-03	-3.29E-03	-4.07E-03
Ivih (A)	4.43E-03	3.28E-03	5.10E-03
	TYP	MAX	MIN
Rtt (Model)	39.98	48.65	34.88
Rtt (datasheet-in units of ZQ/12)	1.0	1.65	0.9
Rtt (datasheet)	30	49.5	27

ODT40	TYP	MIN	MAX
Vil (V)	0.515	0.4815	0.565
Vih (V)	0.835	0.8015	0.885
Ivil (A)	-2.67E-03	-2.46E-03	-2.99E-03
Ivih (A)	3.33E-03	2.47E-03	3.59E-03
	TYP	MAX	MIN
Rtt (Model)	53.30	64.87	48.67
Rtt (datasheet-in units of ZQ/12)	1.0	1.65	0.9
Rtt (datasheet)	40	66	36

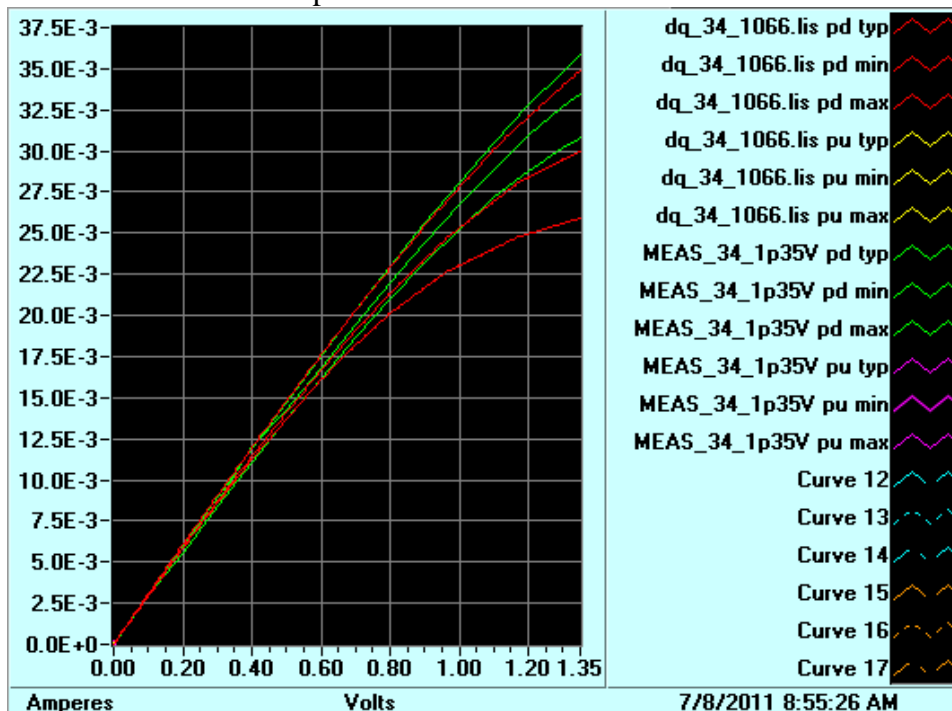
ODT60	TYP	MIN	MAX
Vil (V)	0.515	0.4815	0.565
Vih (V)	0.835	0.8015	0.885
Ivil (A)	-1.78E-03	-1.64E-03	-1.90E-03
Ivih (A)	2.23E-03	1.65E-03	2.72E-03
	TYP	MAX	MIN
Rtt (Model)	79.94	97.31	69.22
Rtt (datasheet-in units of ZQ/12)	1.0	1.65	0.9
Rtt (datasheet)	60	99	54

ODT120	TYP	MIN	MAX
Vil (V)	0.515	0.4815	0.565
Vih (V)	0.835	0.8015	0.885
Ivil (A)	-8.86E-04	-8.17E-04	-8.18E-04
Ivih (A)	1.12E-03	8.27E-04	1.53E-03
	TYP	MAX	MIN
Rtt (Model)	159.82	194.63	136.45
Rtt (datasheet-in units of ZQ/12)	1.0	1.65	0.9
Rtt (datasheet)	120	198	108

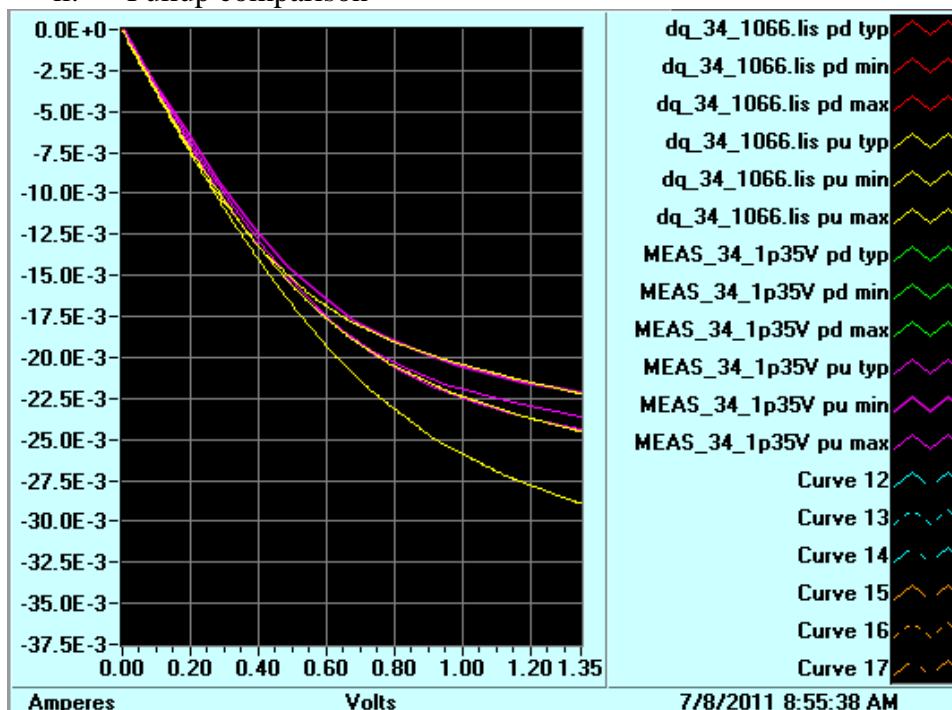
Measurement Correlation

1. ☒ 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.⁵

- a. Model name: **DQ_34_1066**
i. Pulldown comparison

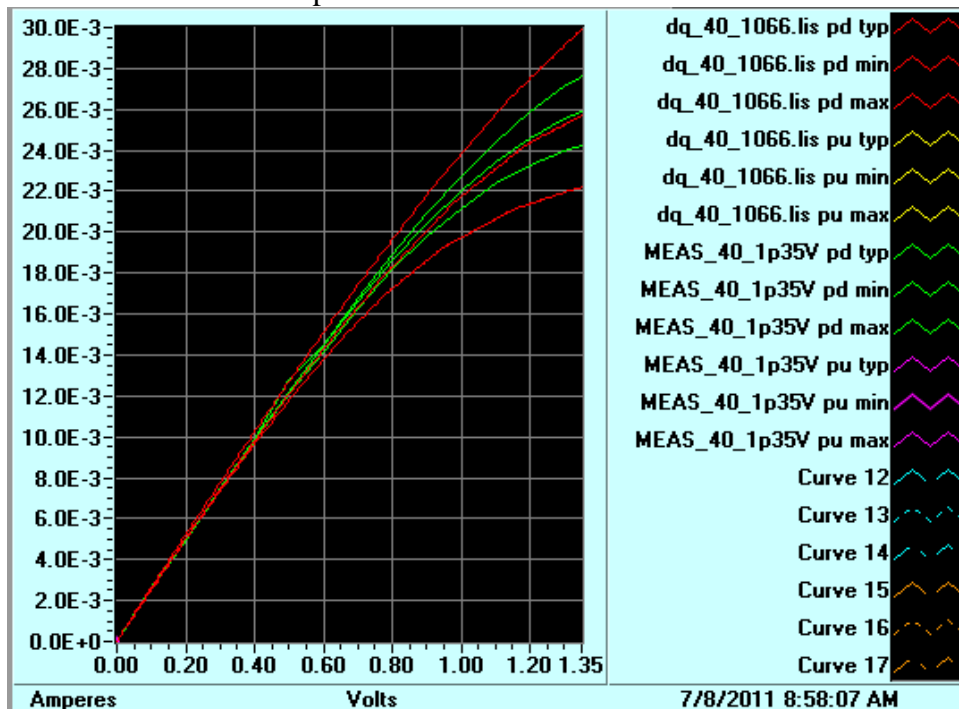


- ii. Pullup comparison

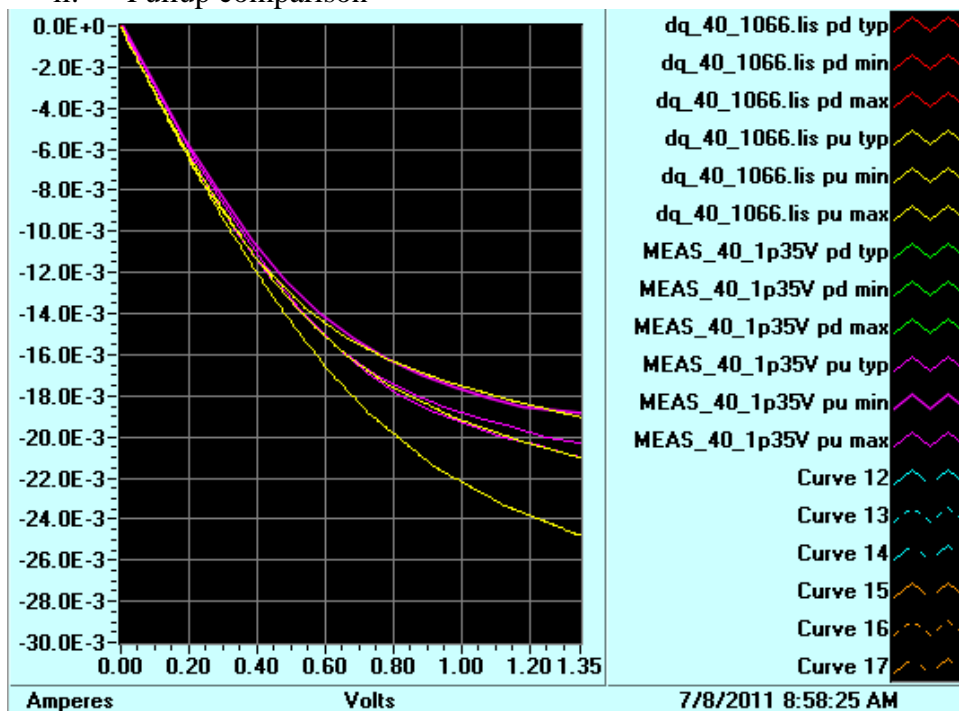


b. Model name: **DQ_40_1066**

i. Pulldown comparison



ii. Pullup comparison



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).

Component name: **MT41K256M4JP, MT41K128M8JP (78-Ball x4/x8)**

		IBIS (pF)			Measured (pF)		
		min	typ	max	min	typ	max
DQ	C_comp	1.26	1.36	1.46	NA	NA	NA
	C package	0.35	0.43	0.54	NA	NA	NA
	C_total	1.61	1.79	2.00	1.71	1.79	1.90
INPUT	C_comp	0.52	0.62	0.72	NA	NA	NA
	C package	0.29	0.40	0.56	NA	NA	NA
	C_total	0.81	1.02	1.28	0.88	0.96	1.08
CLK	C_comp	0.56	0.66	0.76	NA	NA	NA
	C package	0.30	0.31	0.31	NA	NA	NA
	C_total	0.86	0.97	1.07	0.94	0.95	0.96

Component name: **MT41K64M16JT (96-Ball x16)**

		IBIS (pF)			Measured (pF)		
		min	typ	max	min	typ	max
DQ	C_comp	1.26	1.36	1.46	NA	NA	NA
	C package	0.32	0.41	0.56	NA	NA	NA
	C_total	1.58	1.77	2.02	1.68	1.77	1.92
INPUT	C_comp	0.52	0.62	0.72	NA	NA	NA
	C package	0.29	0.43	0.57	NA	NA	NA
	C_total	0.81	1.05	1.29	0.91	0.97	1.08
CLK	C_comp	0.56	0.66	0.76	NA	NA	NA
	C package	0.31	0.32	0.33	NA	NA	NA
	C_total	0.87	0.98	1.09	0.93	0.95	0.95

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

Not Available

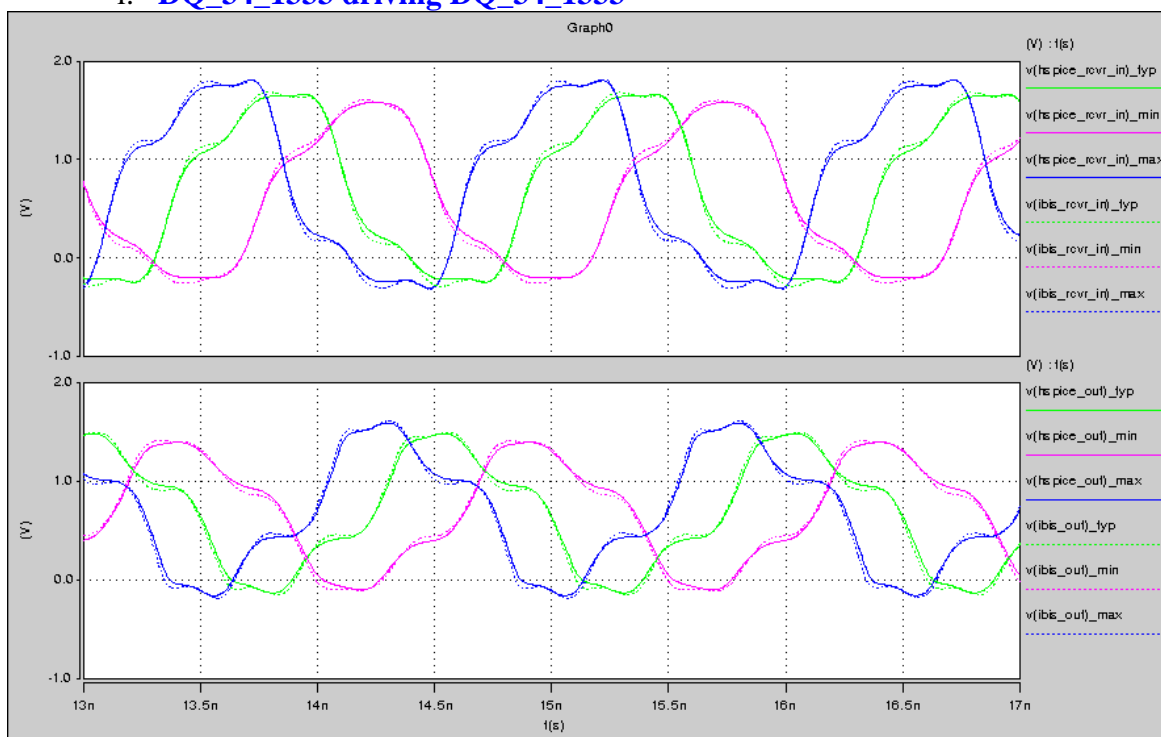
4. ☒ If slew rate data (rise/fall slew) is available from measurements, complete HSpice simulations to generate slew rate data and provide a comparison table.⁴

Model	Slew Rate (V/ns)	IBIS			Measurement	
		min	typ	max	min	max
DQ_34_1066	Rising	2.65	3.60	4.68	2.78	3.66
	Falling	2.75	3.91	5.34	2.91	3.71
DQ_34_1333	Rising	2.65	3.60	4.68	2.77	3.67
	Falling	2.75	3.91	5.34	2.94	3.72
DQ_34_1600	Rising	2.83	3.60	4.68	2.74	3.61
	Falling	3.06	3.91	5.34	2.96	3.75

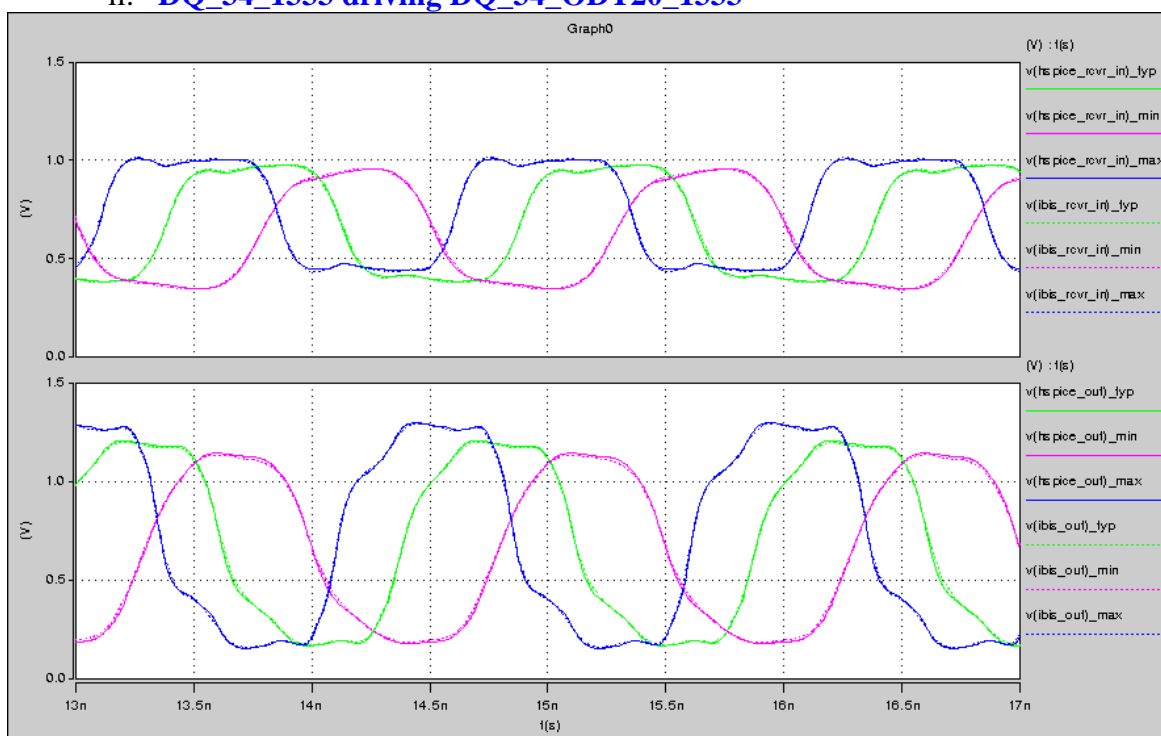
IBIS vs HSPICE Correlation

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: **2008.09**
 - b. ☒ Run simulations for all corners cases and at maximum allowable speed grade

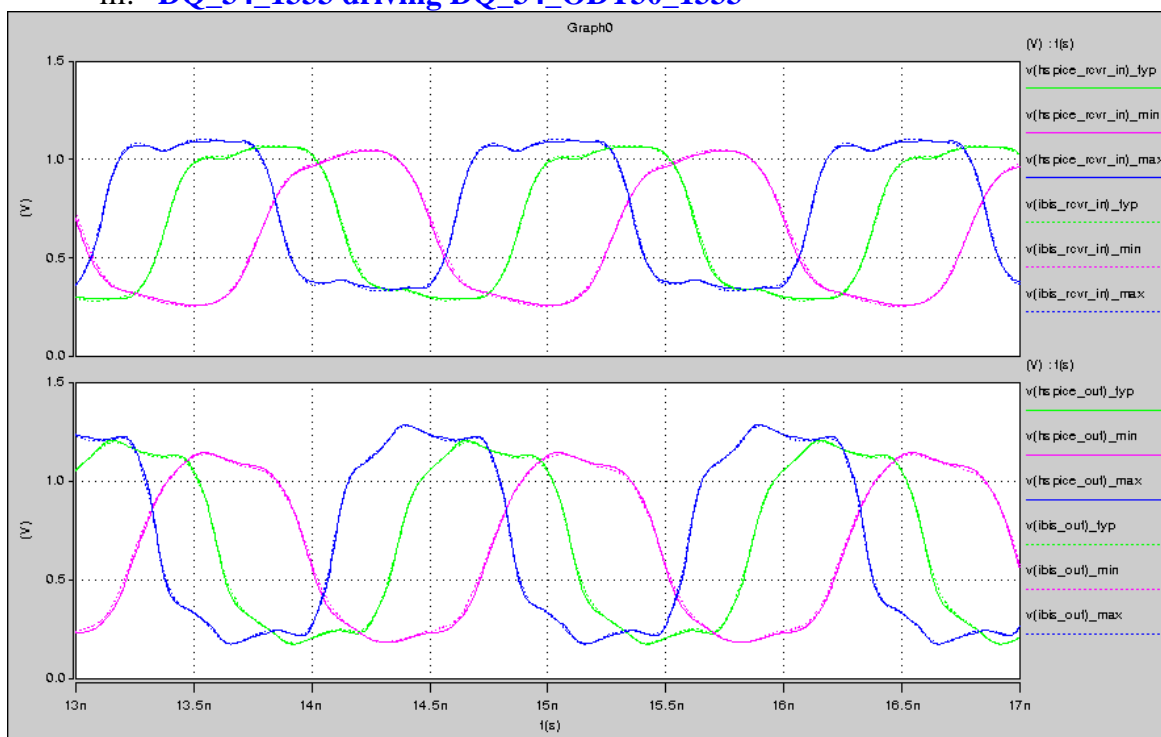
i. DQ_34_1333 driving DQ_34_1333



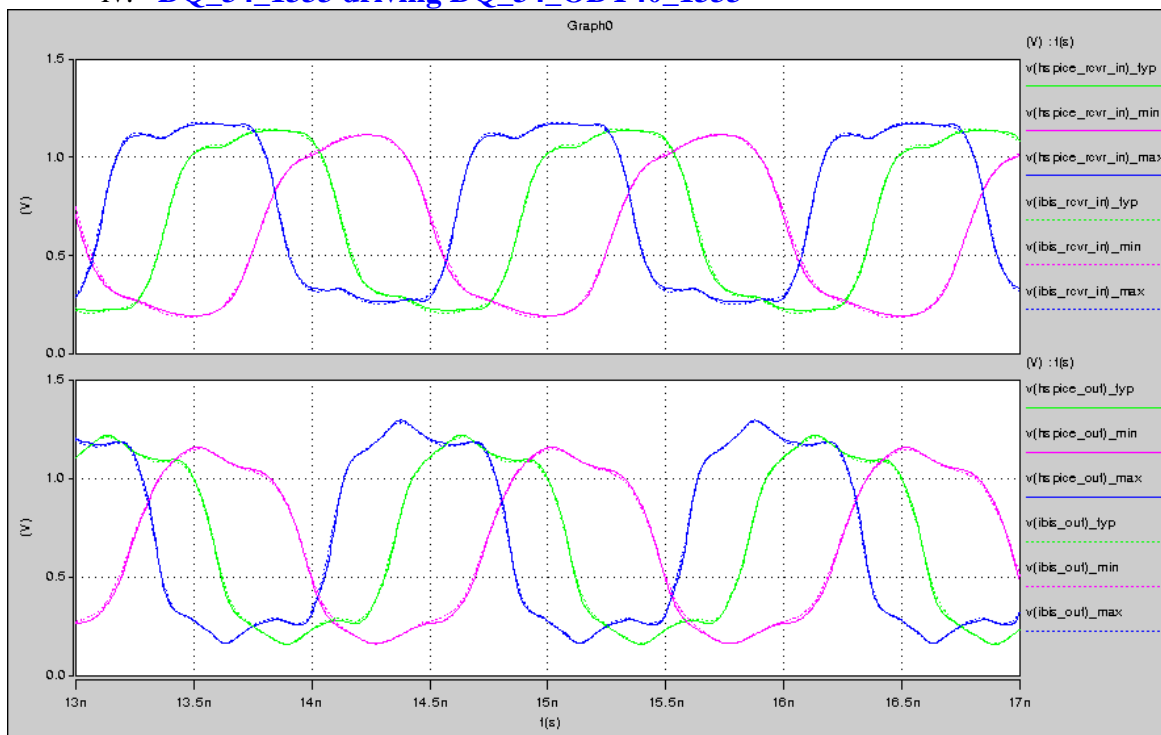
ii. DQ_34_1333 driving DQ_34_ODT20_1333



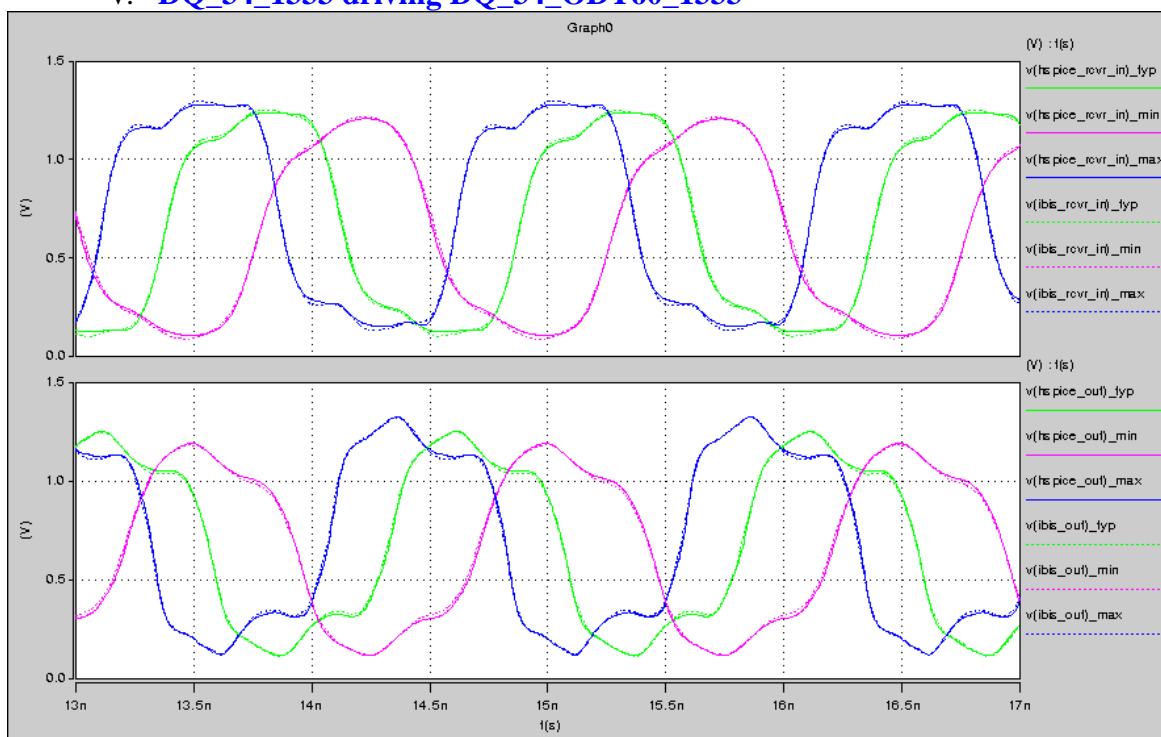
iii. DQ_34_1333 driving DQ_34_ODT30_1333



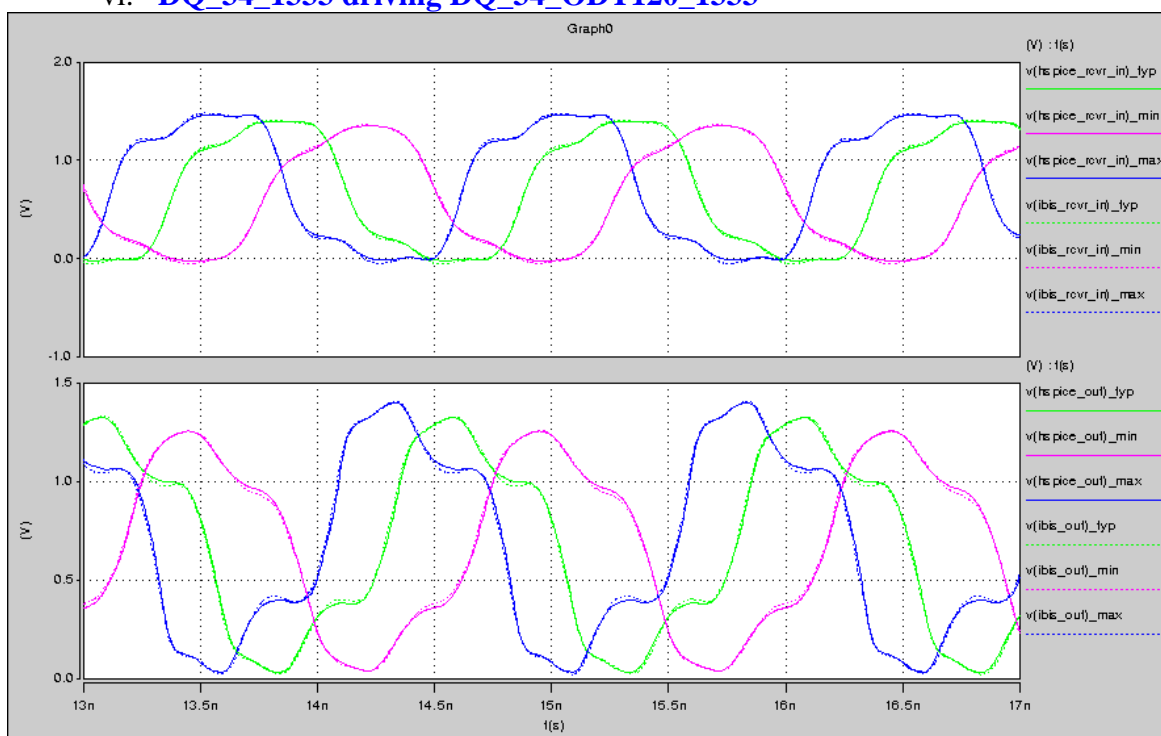
iv. DQ_34_1333 driving DQ_34_ODT40_1333



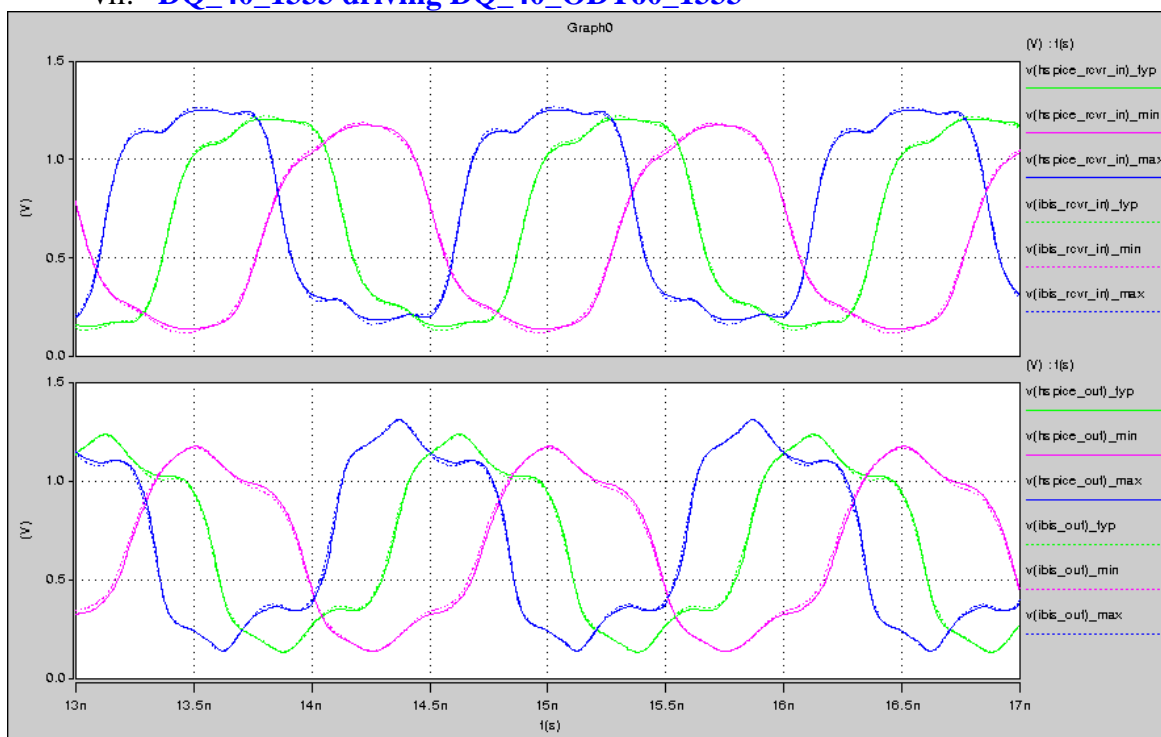
v. **DQ_34_1333 driving DQ_34_ODT60_1333**



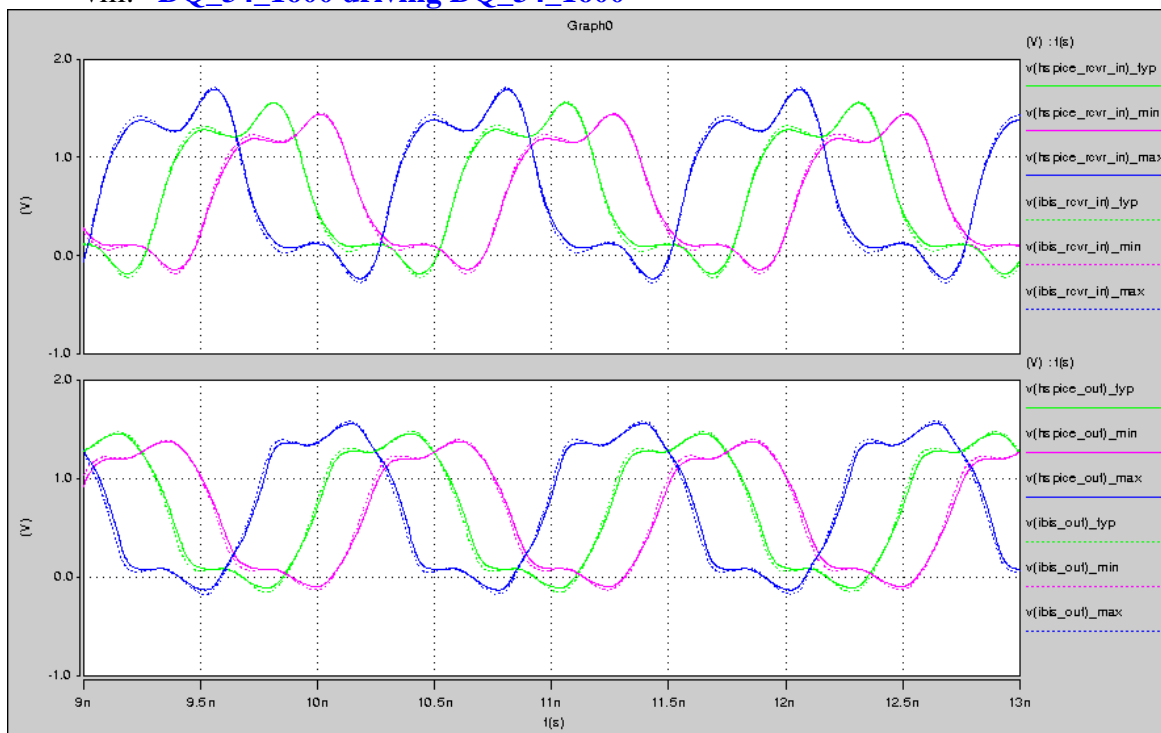
vi. **DQ_34_1333 driving DQ_34_ODT120_1333**



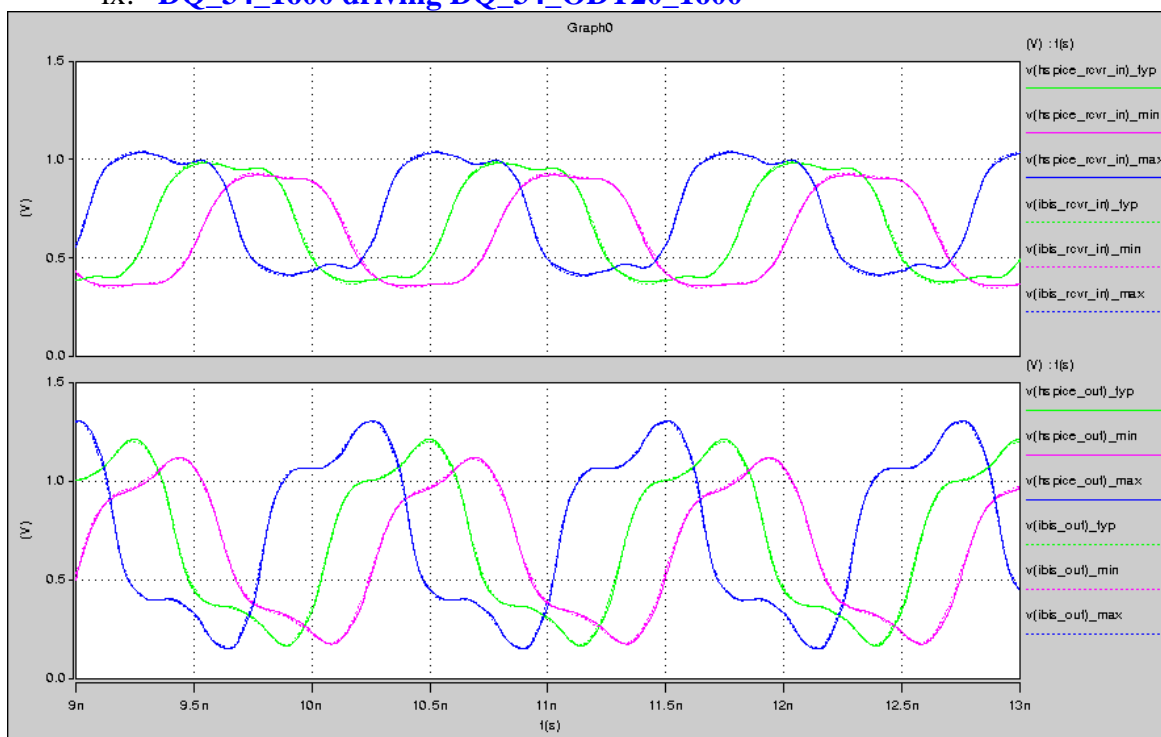
vii. **DQ_40_1333 driving DQ_40_ODT60_1333**



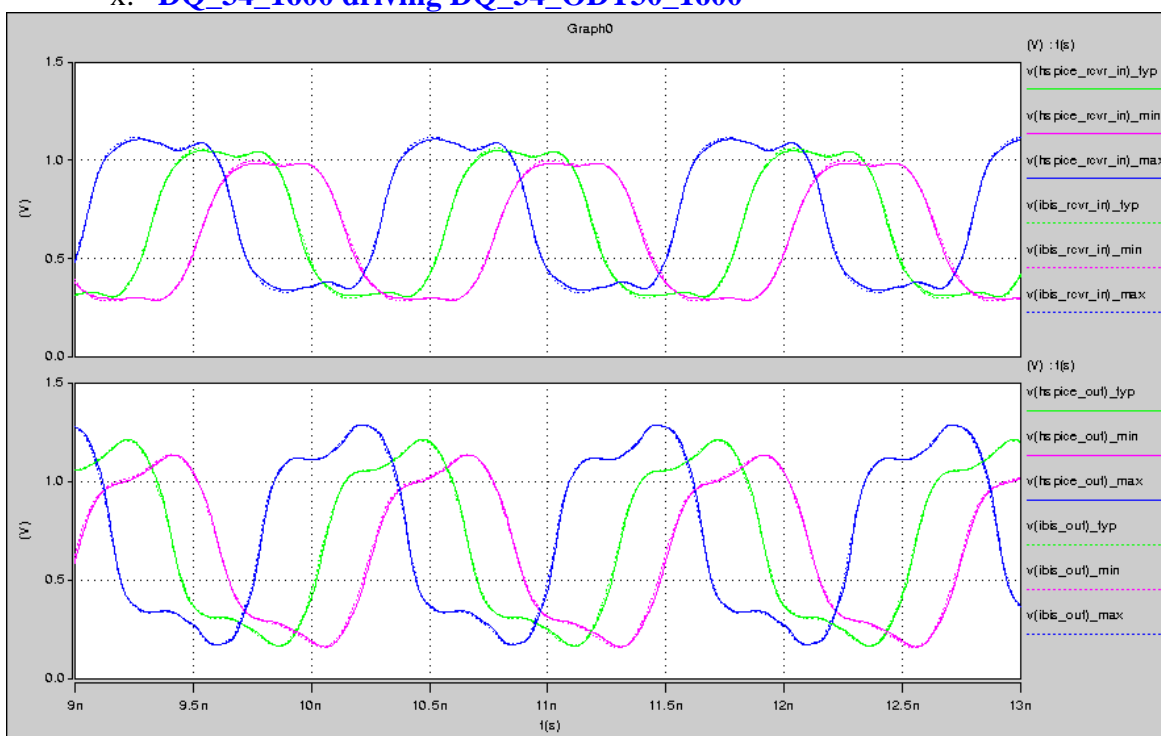
viii. **DQ_34_1600 driving DQ_34_1600**



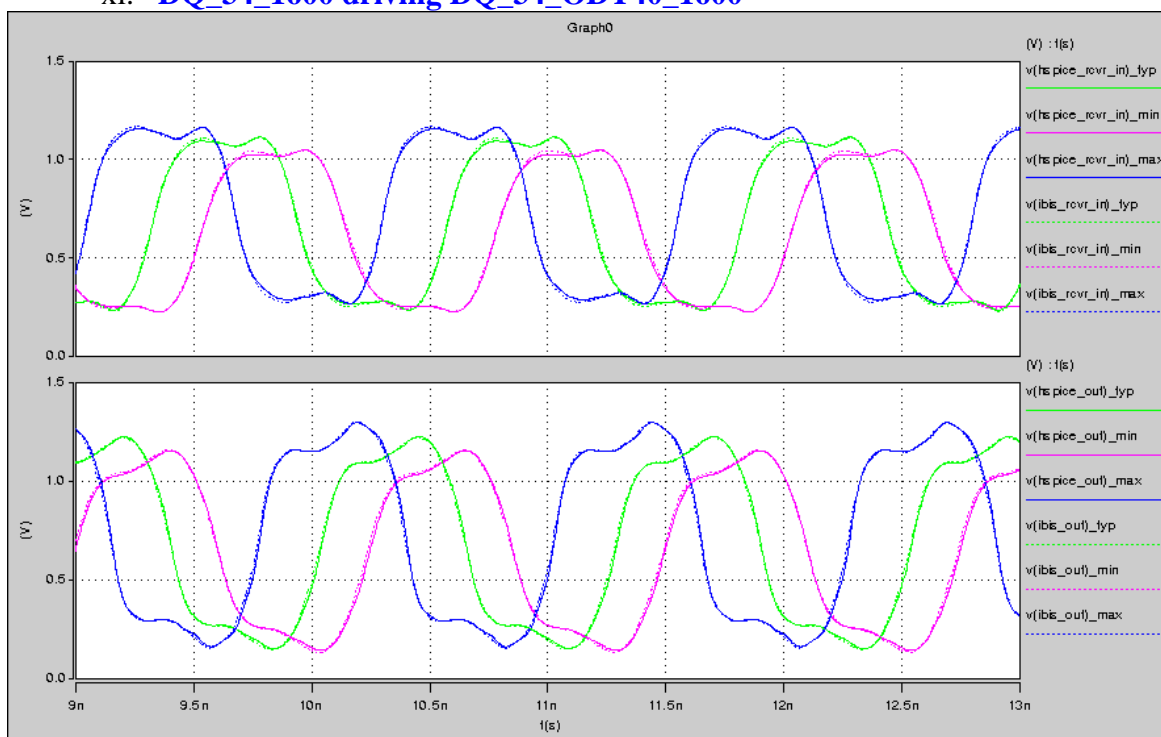
ix. **DQ_34_1600 driving DQ_34_ODT20_1600**



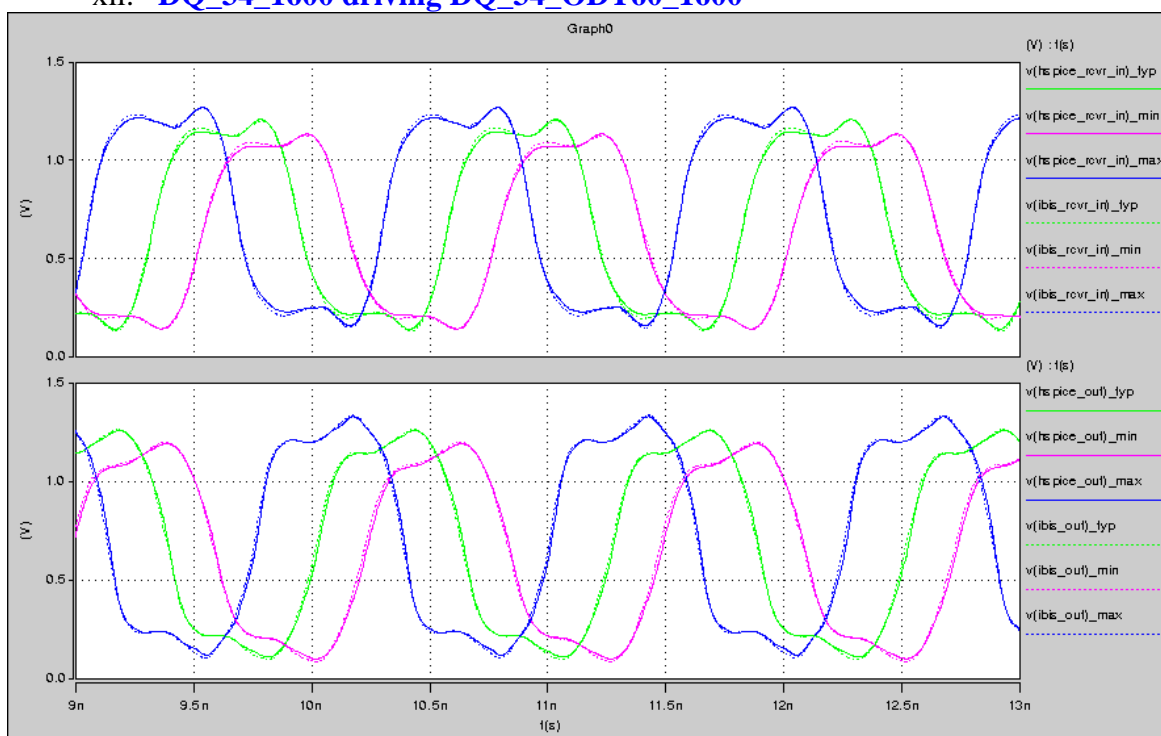
x. **DQ_34_1600 driving DQ_34_ODT30_1600**



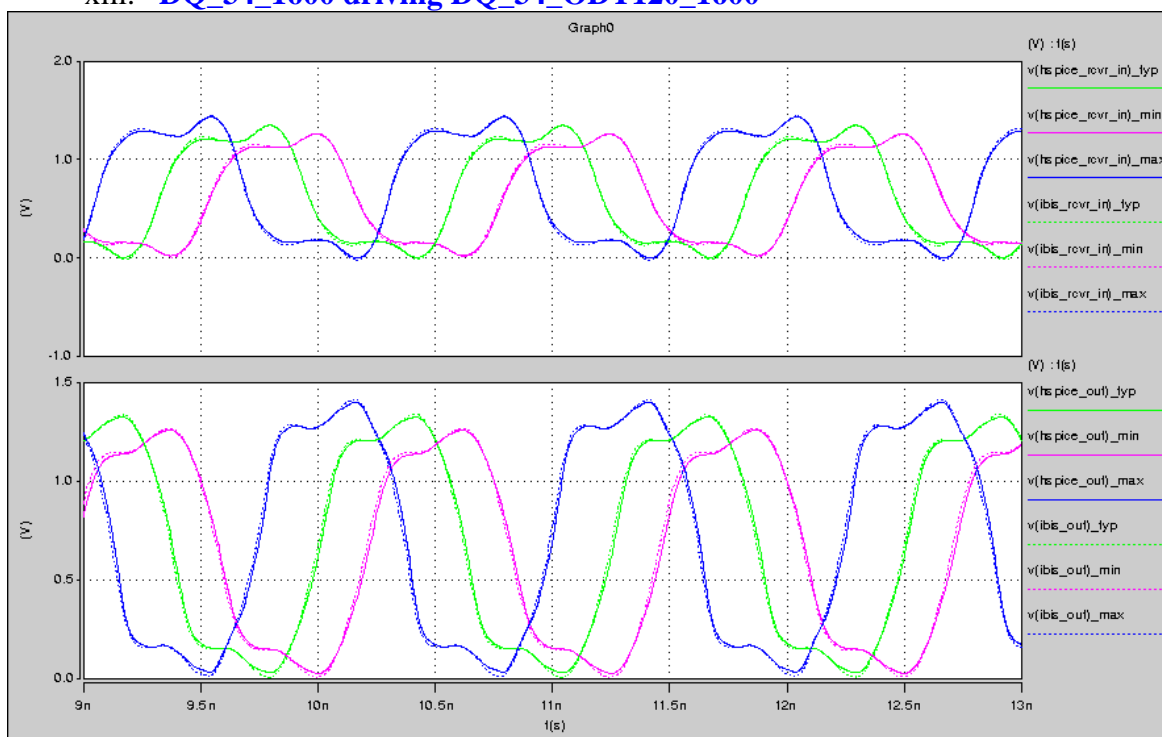
xi. **DQ_34_1600 driving DQ_34_ODT40_1600**



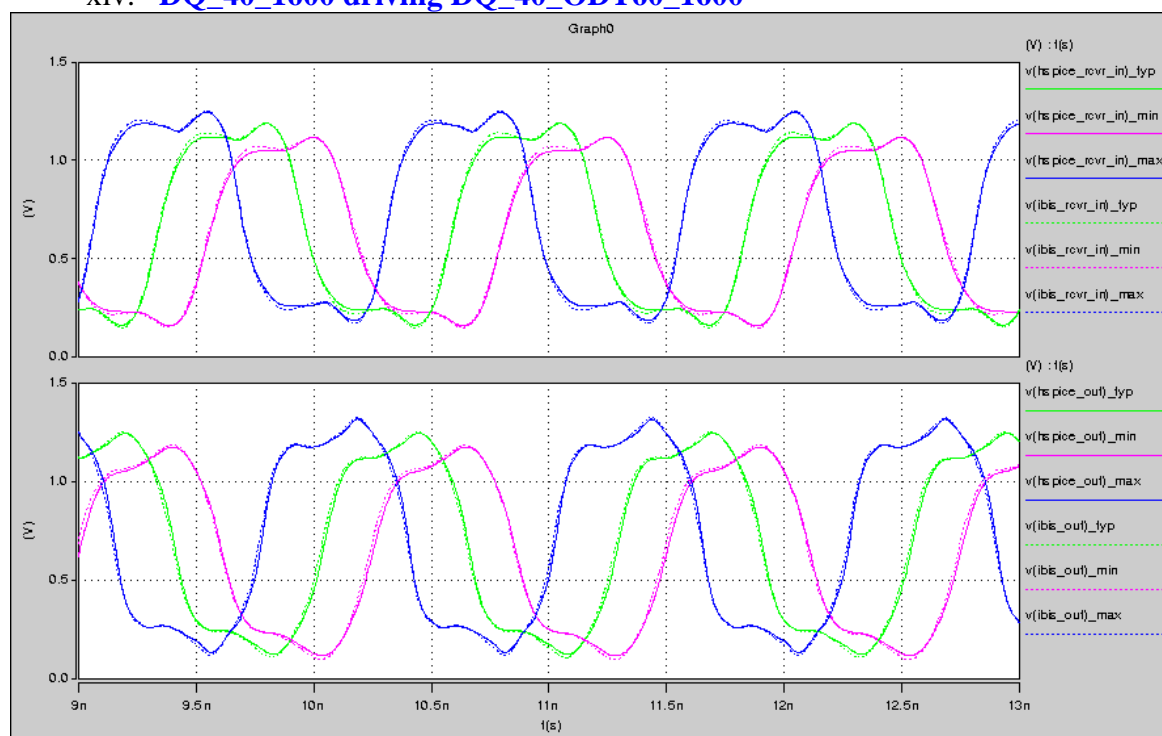
xii. **DQ_34_1600 driving DQ_34_ODT60_1600**



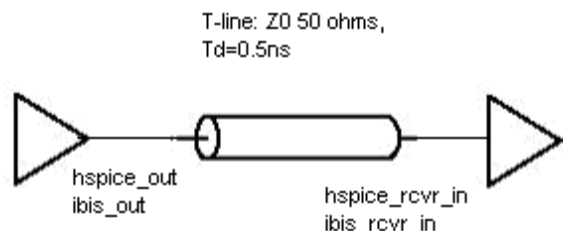
xiii. **DQ_34_1600 driving DQ_34_ODT120_1600**



xiv. **DQ_40_1600 driving DQ_40_ODT60_1600**



Setup



Comments:

1. IBIS model may not reflect speed grade availability.
2. IBIS version is 4.2.
3. C_comp is compared with the DDR3L-1600 specification only.
4. Slew rate is based on HSPICE simulation with a 25ohm load to VTT. This includes simple package parasitics for pin and power/gnd nets.
5. Measurement data taken is taken at 1.35V 25C for typical corner, 1.283V 95C for minimum corner and 1.425V 0C for maximum corner.

Document Revision History

Rev **1.0** - Date **1/22/2010**

- a. IBIS revision **1.0**
- b. HSpice revision **1.0**

Rev **2.0** - Date **7/2/2010**

- a. IBIS revision **2.0**
- b. HSpice revision **2.0**

Rev **2.1** - Date **7/8/2011**

- a. IBIS revision **2.1**
- b. HSpice revision **2.1**

Rev **2.2** - Date **11/26/2014**

- a. IBIS revision **2.2**
- b. HSpice revision **2.1**