IBIS/HSPICE Model Quality Report

Design ID: V68A
Description: 1Gb DDR3 SDRAM
Marketing device name(s): MT41J256M4JP, MT41J128M8JP, MT41J64M16JT, MT41J256M4V68A, MT41J128M8V68A, MT41J64M16V68A
Valid speed grades: DDR3-1066, DDR3-1333, DDR3-1600, DDR3-1866 [1]
Zip filename: v68a_ibis.zip
IBIS filename: v68a.ibs, v68a_it.ibs [2] **File rev:** 2.2
HSpice filename: v68a_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: 1.425V **Typical:** 1.500V **Fast:** 1.575V
VDD – Slow: 1.425V **Typical:** 1.500V **Fast:** 1.575V
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

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

   Filename: **v68a_ibis_quality_checklist.xls**

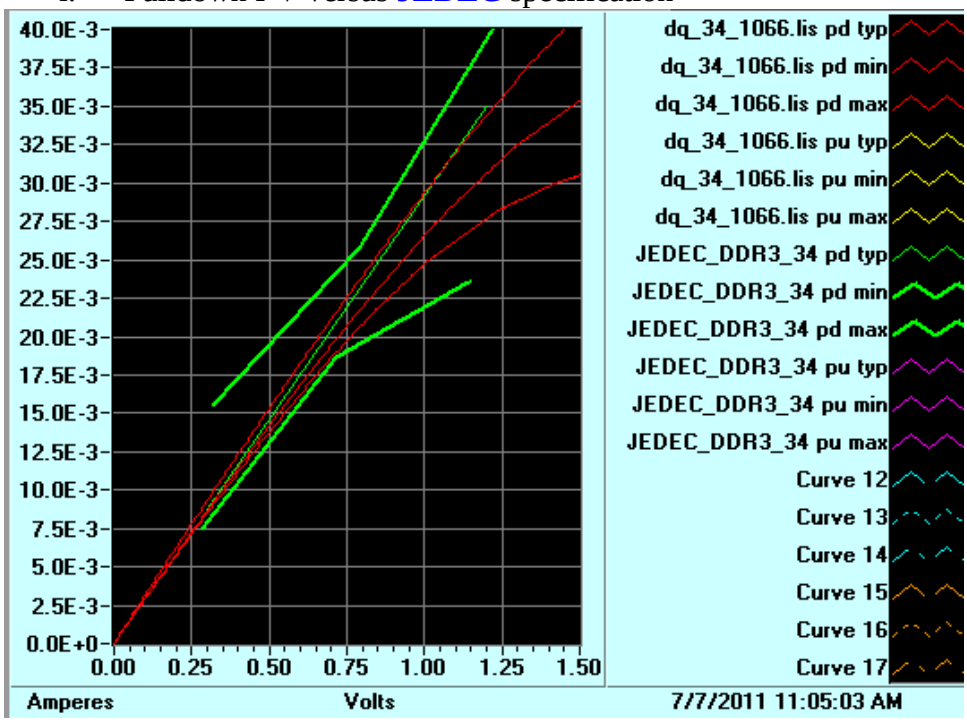
IBIS MODEL Correlation

Datasheet Correlation

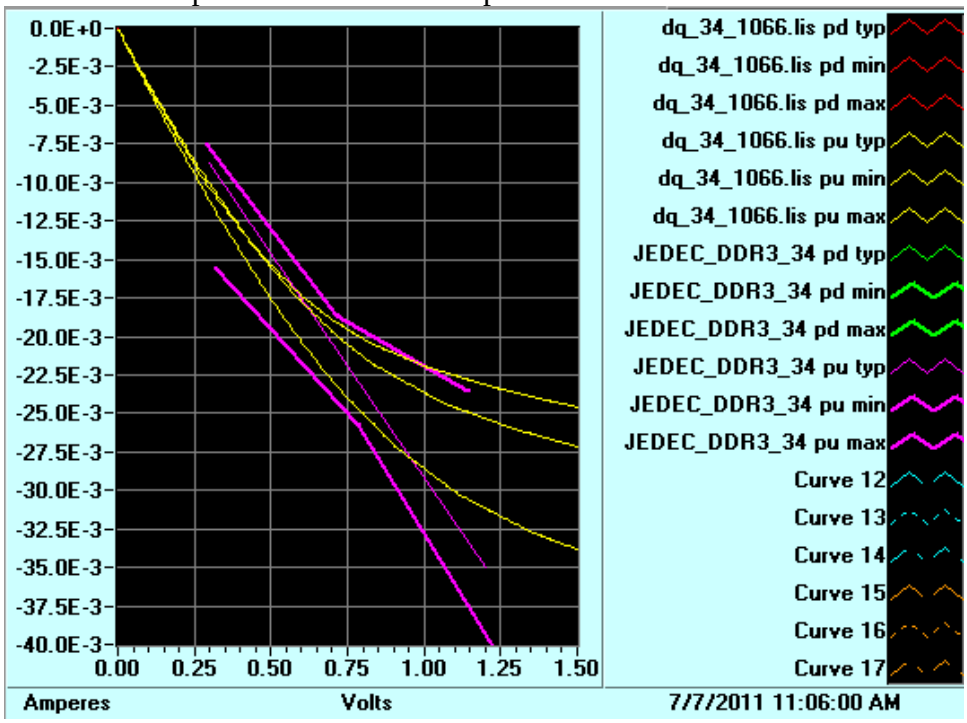
1. ☒ For Output or I/O model compare datasheet IOH/IOL data with IBIS pullup/pulldown data.

a. Model name: **DQ_34_1066**

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

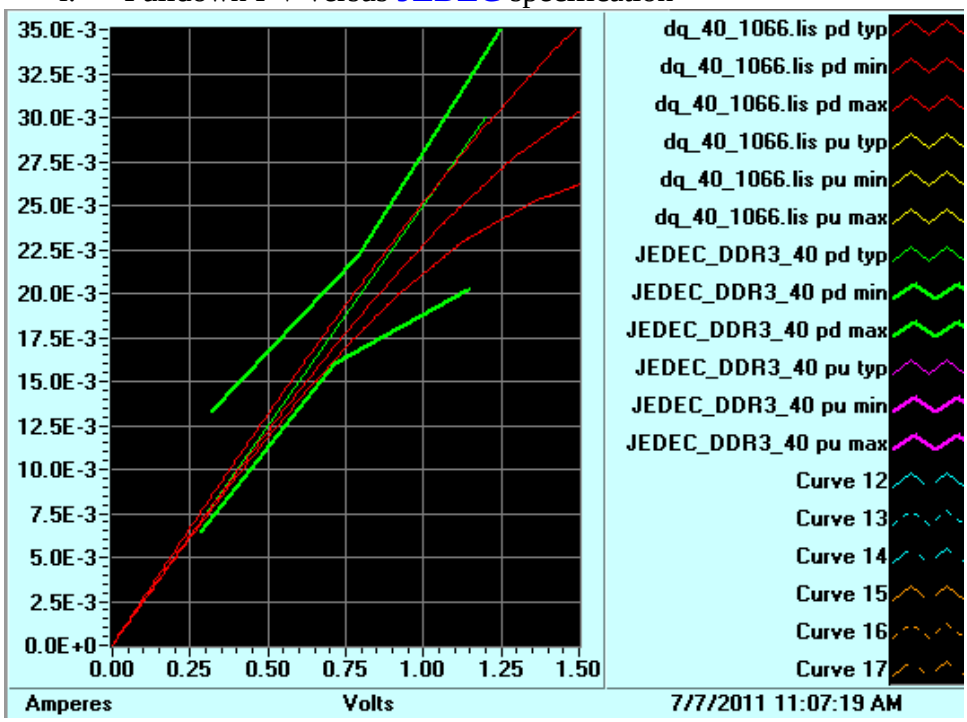


ii. Pullup I-V versus **JEDEC** specification

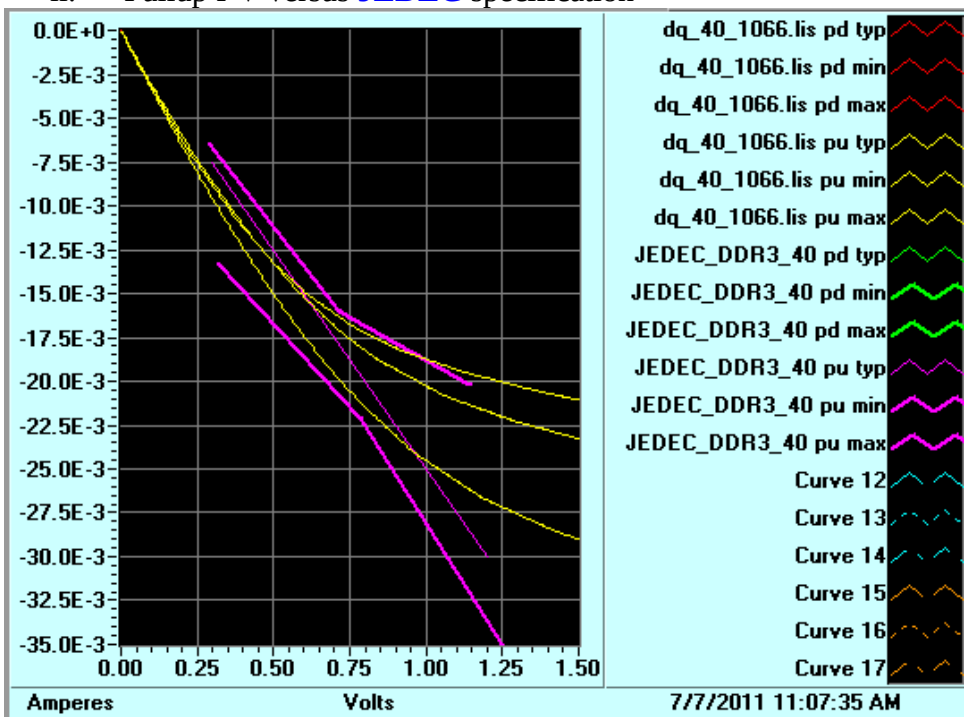


b. Model name: **DQ_40_1066**

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: **MT41J256M4JP, MT41J128M8JP (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: **MT41J64M16JT (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]

		IBIS			Datasheet	
Model	Slew Rate (V/ns)	min	typ	max	min	max
DQ_34_1066	Rising	3.26	4.44	5.71	2.50	6.00
	Falling	3.55	4.78	6.51	2.50	6.00
DQ_40_1066	Rising	3.46	4.96	6.64	2.50	6.00
	Falling	3.63	5.21	7.31	2.50	6.00
DQ_34_1600	Rising	3.09	4.42	5.69	2.50	6.00
	Falling	3.21	4.74	6.52	2.50	6.00
DQ_40_1600	Rising	3.28	4.93	6.58	2.50	6.00
	Falling	3.21	5.26	7.39	2.50	6.00
DQ_34_2133	Rising	3.74	4.53	5.79	2.50	6.00
	Falling	3.94	4.93	6.54	2.50	6.00
DQ_40_2133	Rising	4.07	4.96	6.68	2.50	6.00
	Falling	4.15	5.33	7.31	2.50	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)	0.575	0.5375	0.6125
Vih (V)	0.925	0.8875	0.9625
Iᴠil (A)	-5.50E-03	-5.39E-03	-7.84E-03
Iᴠih (A)	6.95E-03	5.52E-03	7.01E-03
	TYP	MAX	MIN
Rtt (Model)	28.10	32.09	23.57
Rtt (datasheet-in units of ZQ/12)	1.0	1.6	0.9
Rtt (datasheet)	20	32	18

ODT30	TYP	MIN	MAX
Vil (V)	0.575	0.5375	0.6125
Vih (V)	0.925	0.8875	0.9625
Iᴠil (A)	-3.56E-03	-3.58E-03	-5.11E-03
Iᴠih (A)	4.77E-03	3.69E-03	4.44E-03
	TYP	MAX	MIN
Rtt (Model)	42.00	48.11	36.62
Rtt (datasheet-in units of ZQ/12)	1.0	1.6	0.9
Rtt (datasheet)	30	48	27

ODT40	TYP	MIN	MAX
Vil (V)	0.575	0.5375	0.6125
Vih (V)	0.925	0.8875	0.9625
Ivil (A)	-2.59E-03	-2.68E-03	-3.76E-03
Ivih (A)	3.68E-03	2.78E-03	3.72E-03
	TYP	**MAX**	**MIN**
Rtt (Model)	55.81	64.14	46.84
Rtt (datasheet-in units of ZQ/12)	1.0	1.6	0.9
Rtt (datasheet)	40	64	36

ODT60	TYP	MIN	MAX
Vil (V)	0.575	0.5375	0.6125
Vih (V)	0.925	0.8875	0.9625
Ivil (A)	-1.63E-03	-1.78E-03	-2.40E-03
Ivih (A)	2.58E-03	1.86E-03	2.23E-03
	TYP	**MAX**	**MIN**
Rtt (Model)	83.17	96.20	75.55
Rtt (datasheet-in units of ZQ/12)	1.0	1.6	0.9
Rtt (datasheet)	60	96	54

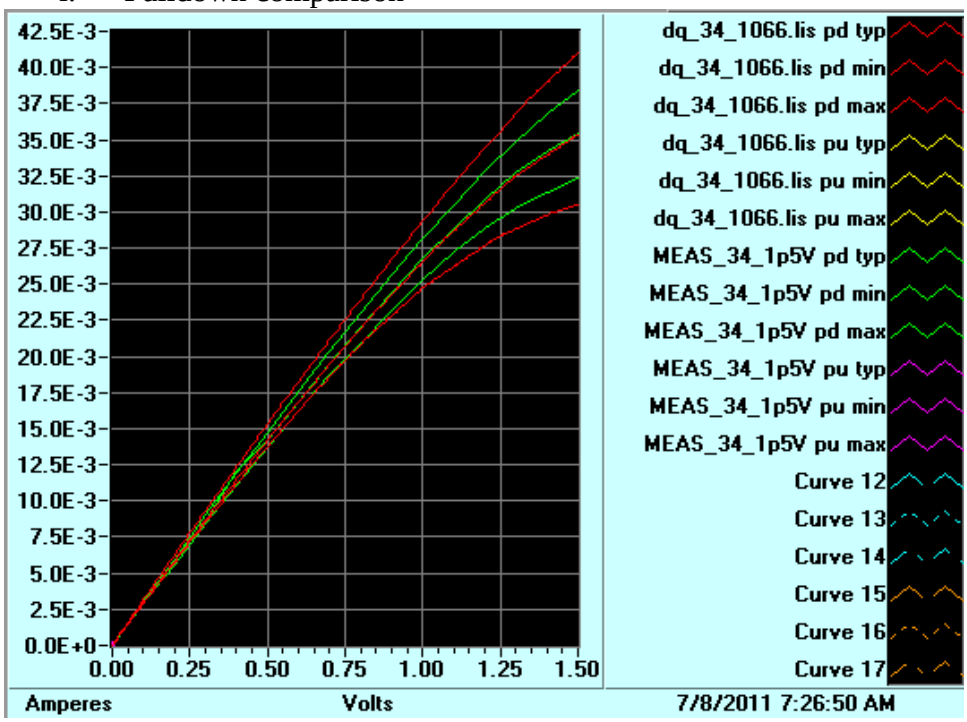
ODT120	TYP	MIN	MAX
Vil (V)	0.575	0.5375	0.6125
Vih (V)	0.925	0.8875	0.9625
Ivil (A)	-6.74E-04	-8.89E-04	-1.05E-03
Ivih (A)	1.47E-03	9.31E-04	1.12E-03
	TYP	**MAX**	**MIN**
Rtt (Model)	163.20	192.34	161.37
Rtt (datasheet-in units of ZQ/12)	1.0	1.6	0.9
Rtt (datasheet)	120	192	108

Measurement Correlation

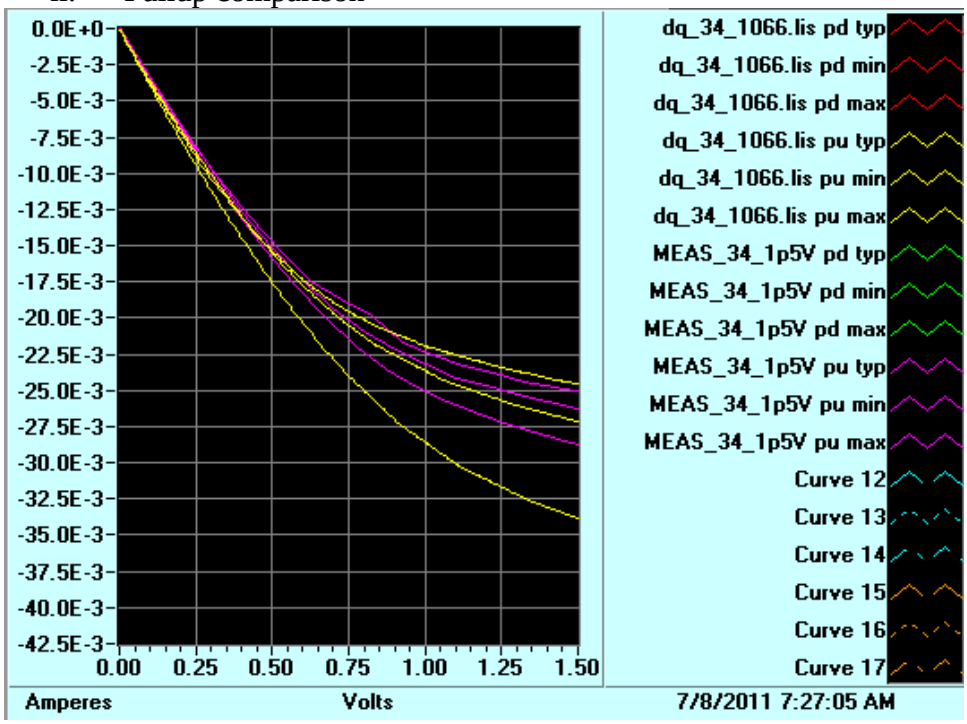
1. ☒ For Output or I/O models compare measured IOH/IOL data with IBIS pullup/pulldown data. If the measurement conditions are different than the IBIS conditions, run HSpice simulations using the same measurement conditions such as VCC, temperature, and process. Include measurement conditions in the pullup/pulldown images. [5]

a. Model name: **DQ_34_1066**

i. Pulldown comparison

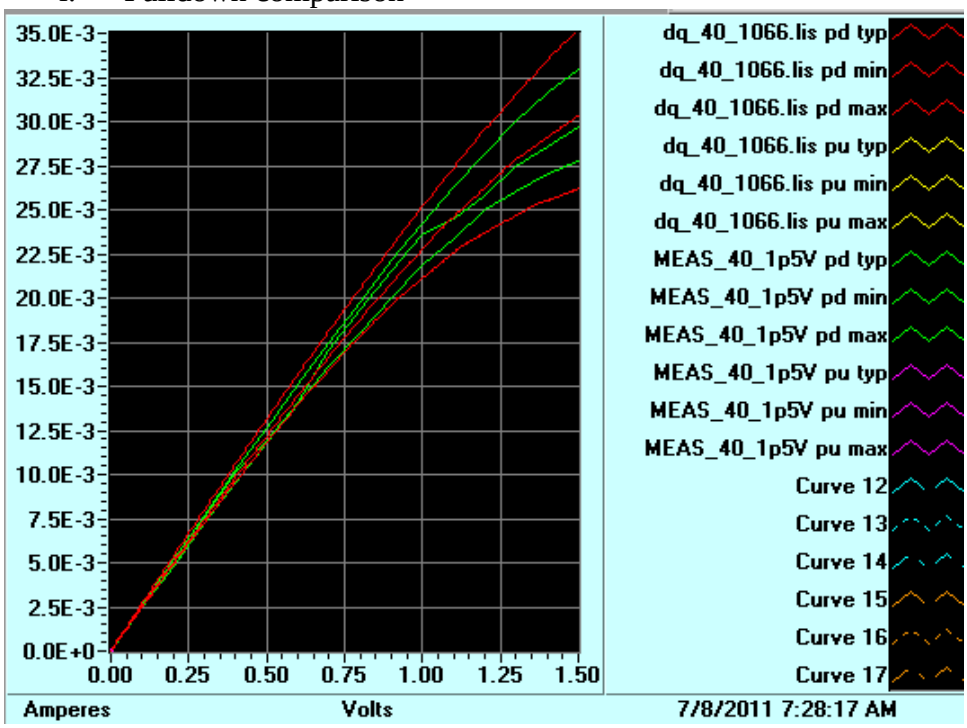


ii. Pullup comparison

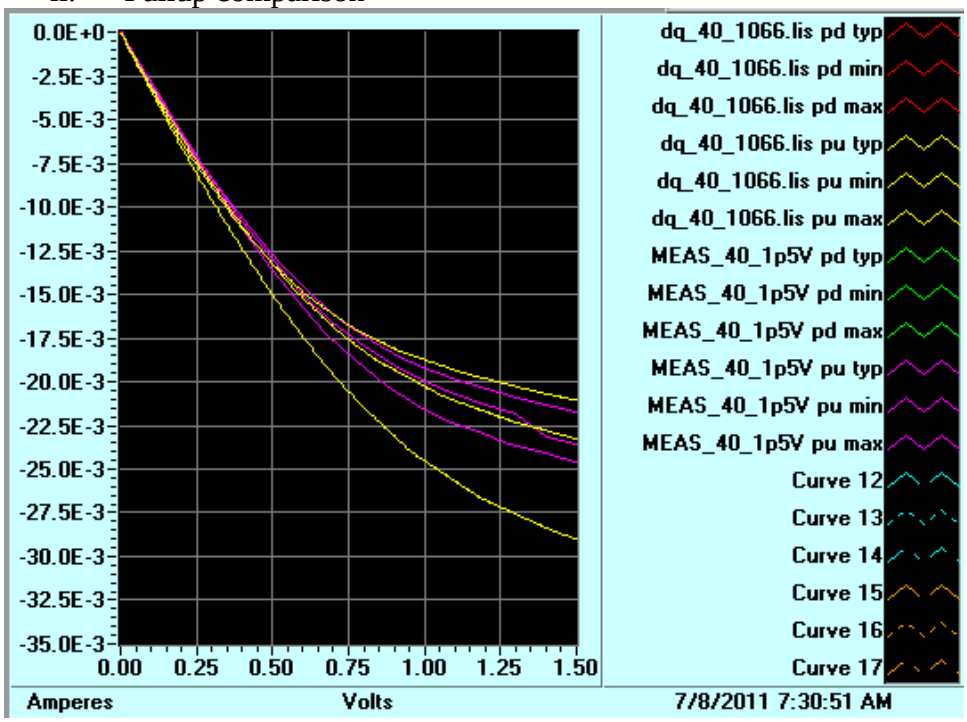


b. Model name: **DQ_40_1066**

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: **MT41J256M4JP, MT41J128M8JP (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: **MT41J64M16JT (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

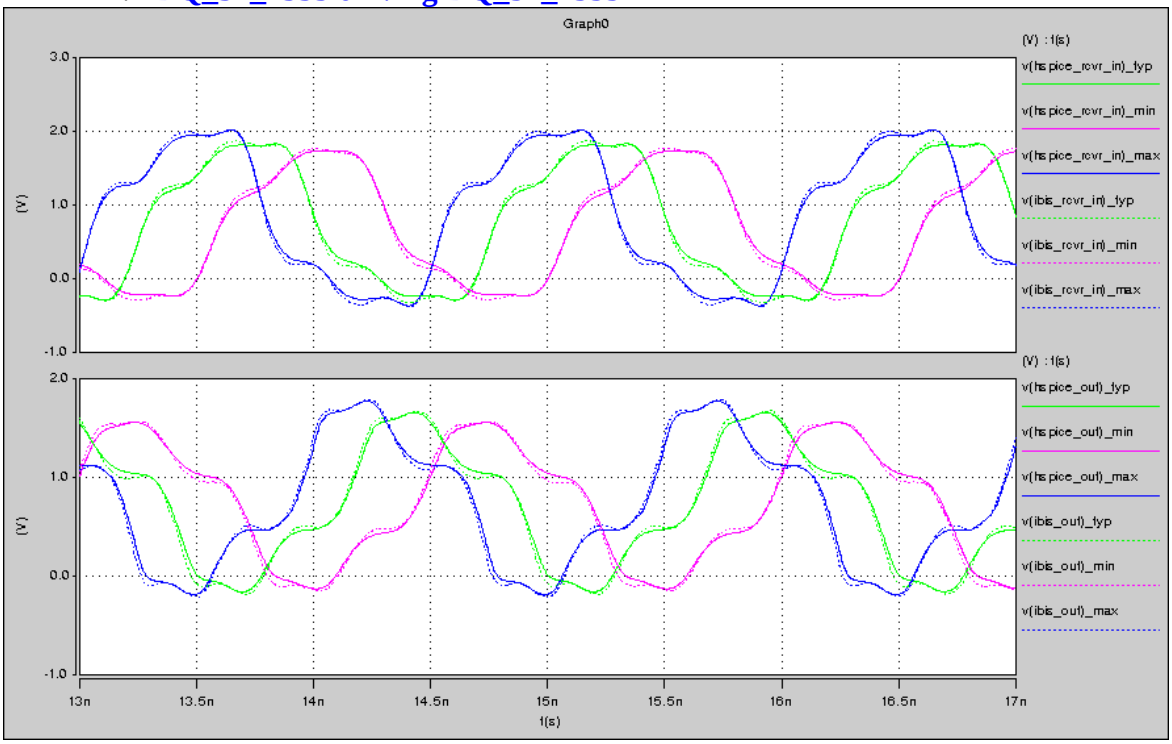
4. ☒ If slew rate data (rise/fall slew) is available from measurements, complete HSpice simulations to generate slew rate data and provide a comparison table. [4]

		IBIS			Measurement	
Model	Slew Rate (V/ns)	min	typ	max	min	max
DQ_34_1333	Rising	3.30	4.35	5.84	3.92	5.16
	Falling	3.61	4.85	6.72	3.77	5.50
DQ_34_1600	Rising	3.51	4.36	5.81	3.92	5.16
	Falling	3.94	4.85	6.72	3.77	5.50
DQ_34_1866	Rising	3.68	4.42	5.84	4.01	5.11
	Falling	3.99	4.92	6.73	4.21	5.70

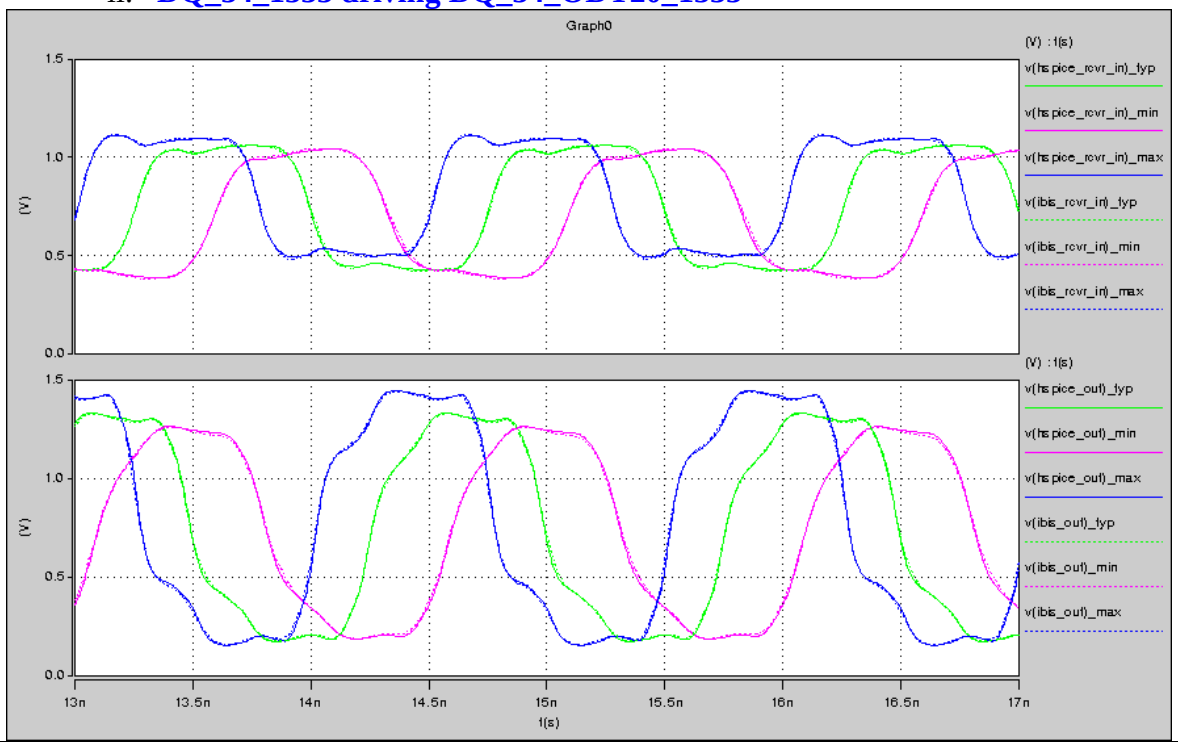
IBIS vs HSPICE Correlation

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

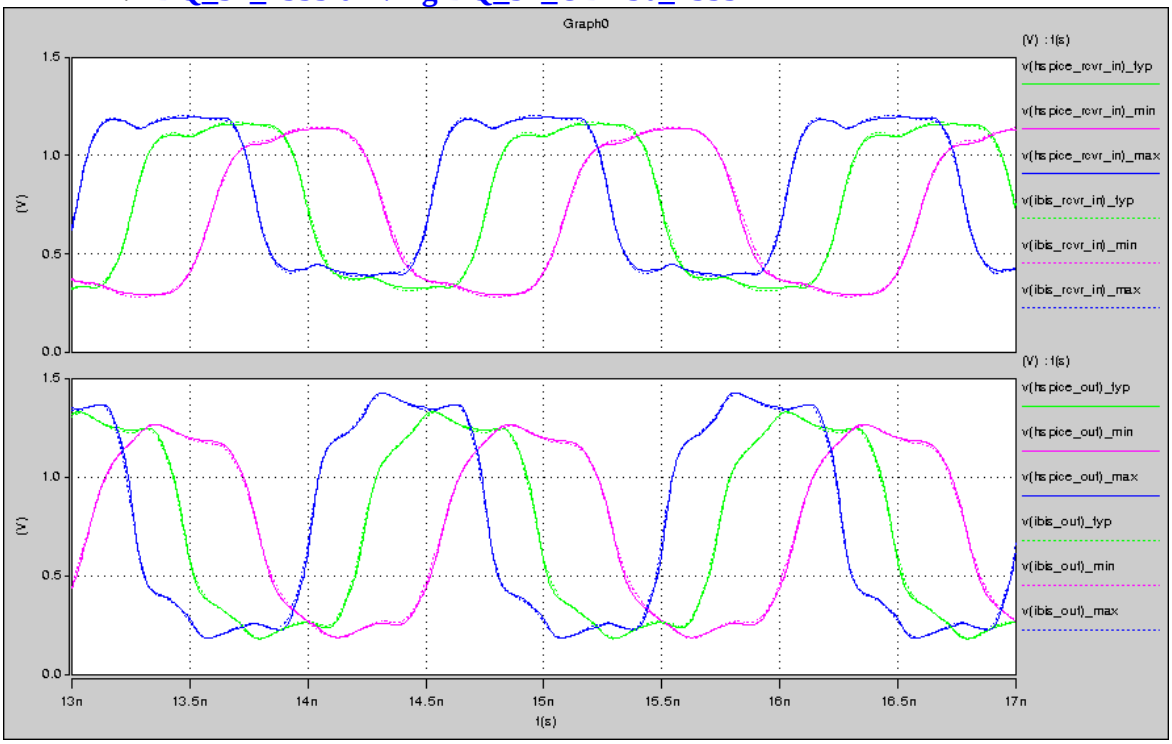
i. **DQ_34_1333 driving DQ_34_1333**



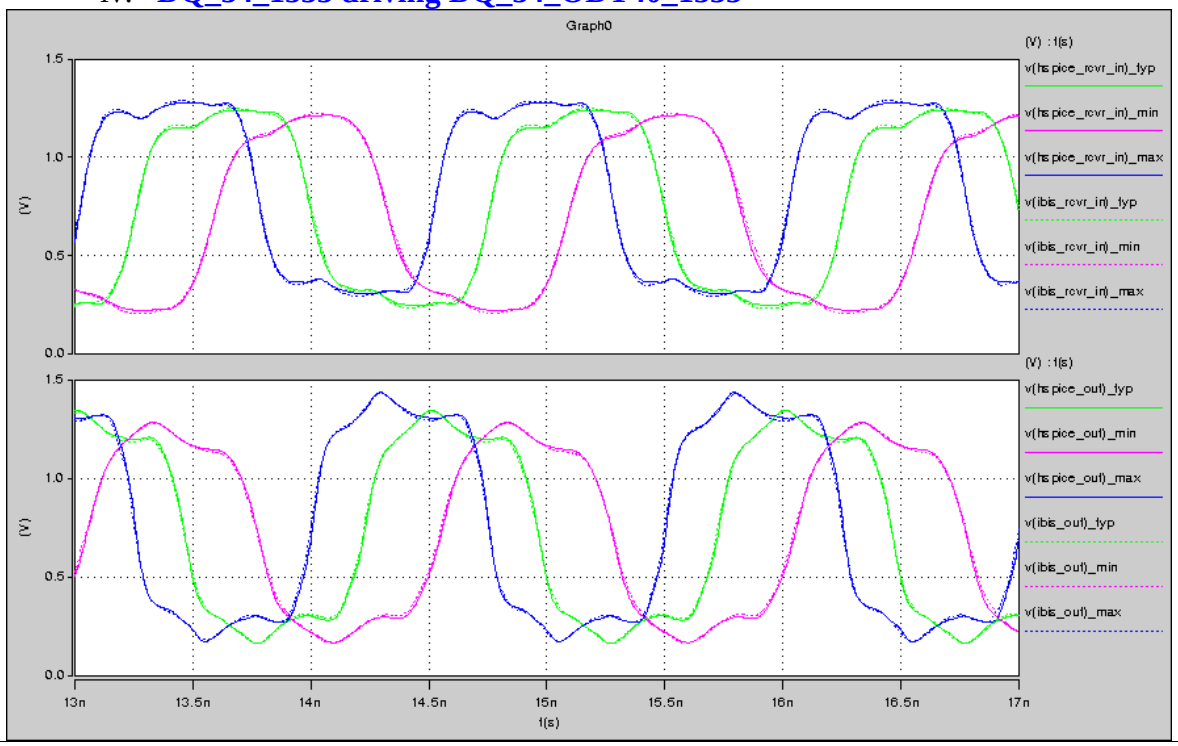
ii. **DQ_34_1333 driving DQ_34_ODT20_1333**



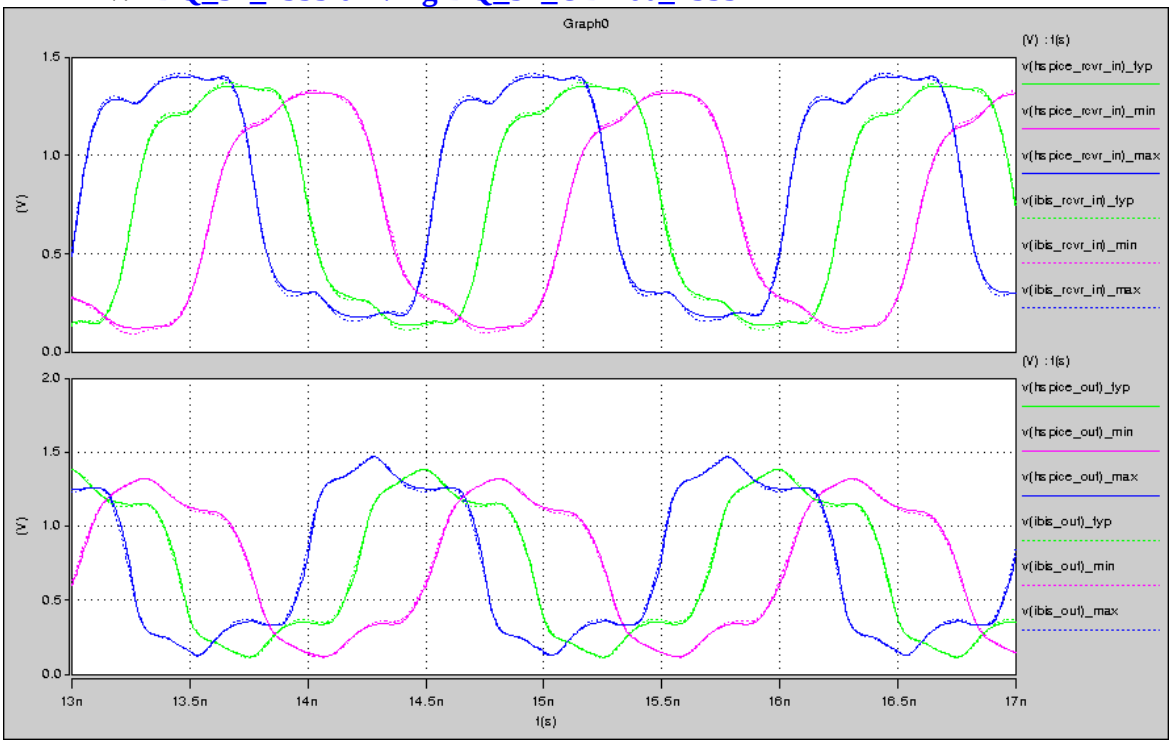
iii. **DQ_34_1333 driving DQ_34_ODT30_1333**



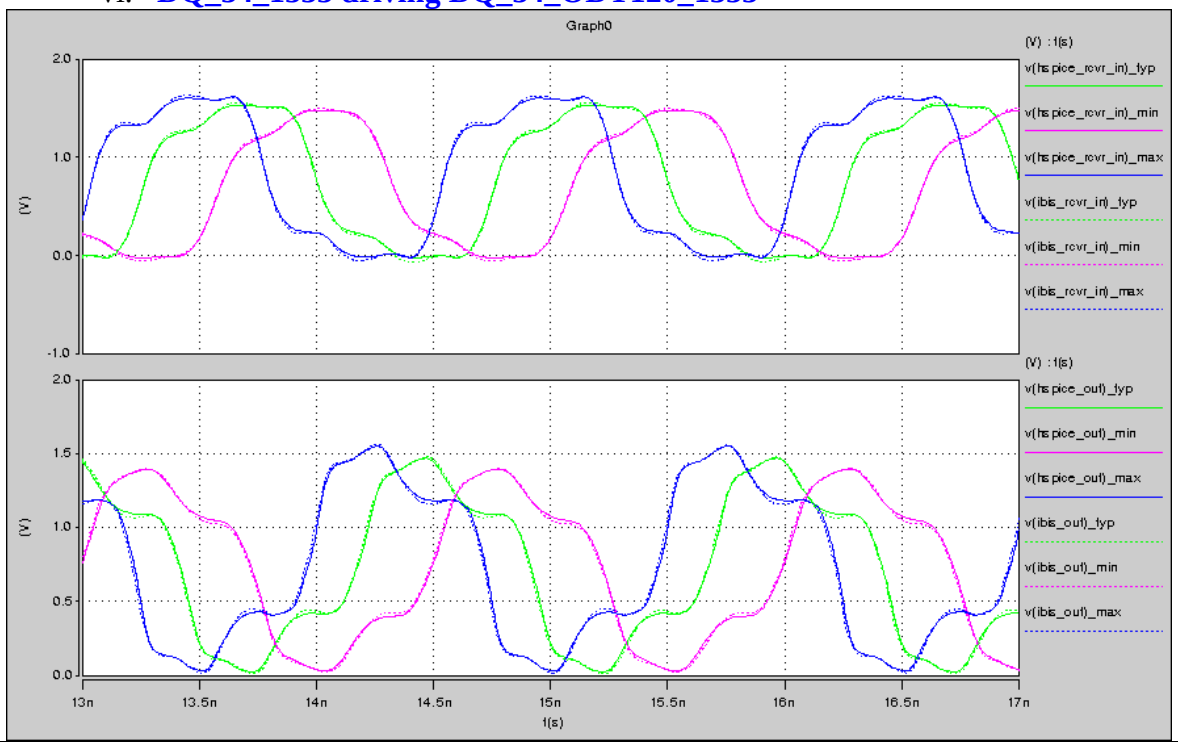
iv. **DQ_34_1333 driving DQ_34_ODT40_1333**



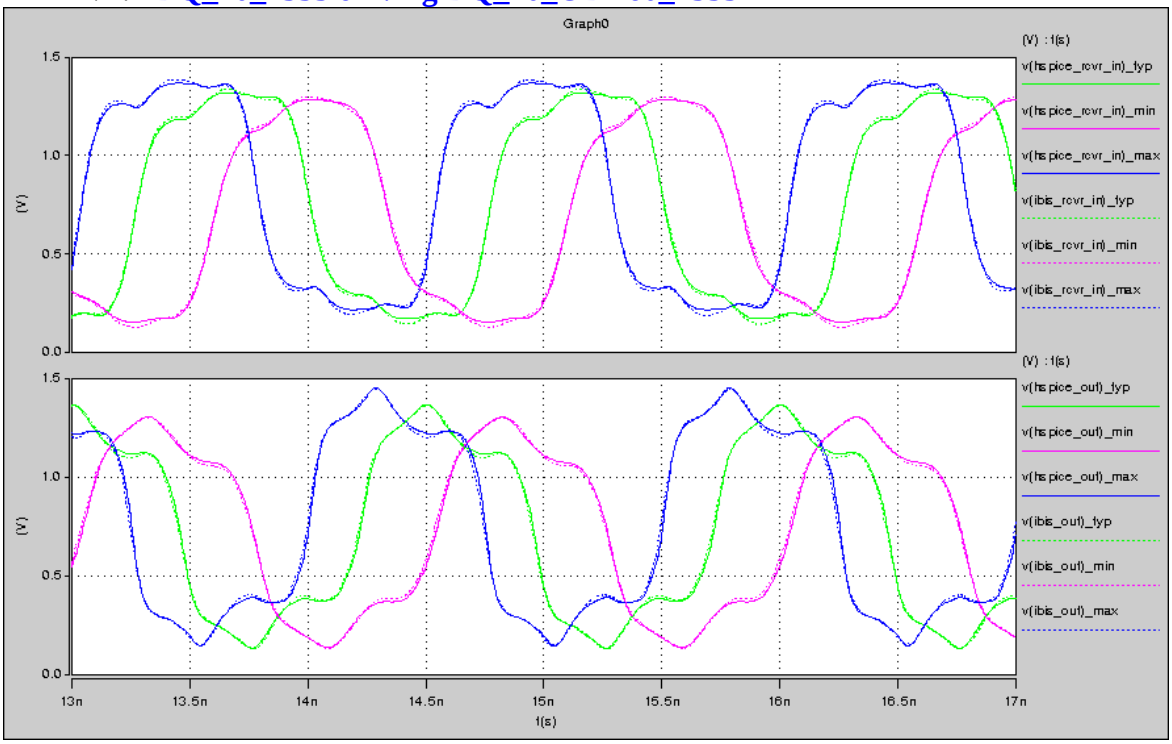
v. **DQ_34_1333 driving DQ_34_ODT60_1333**



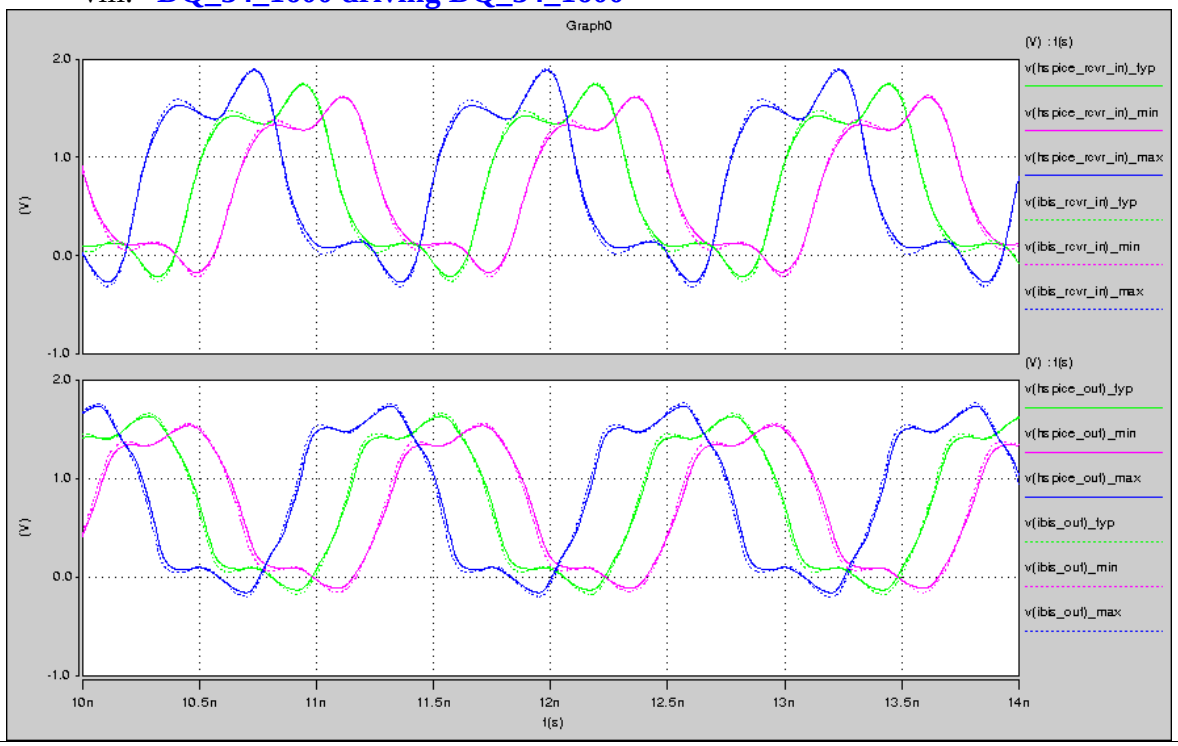
vi. **DQ_34_1333 driving DQ_34_ODT120_1333**



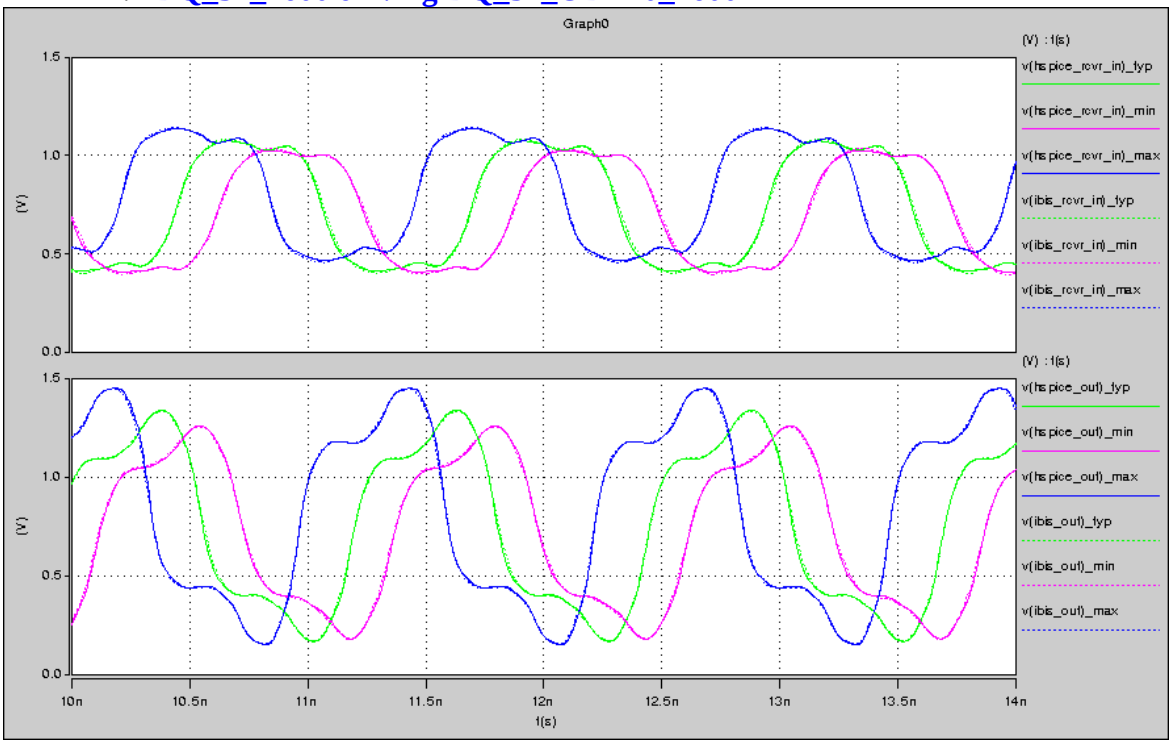
vii. **DQ_40_1333 driving DQ_40_ODT60_1333**



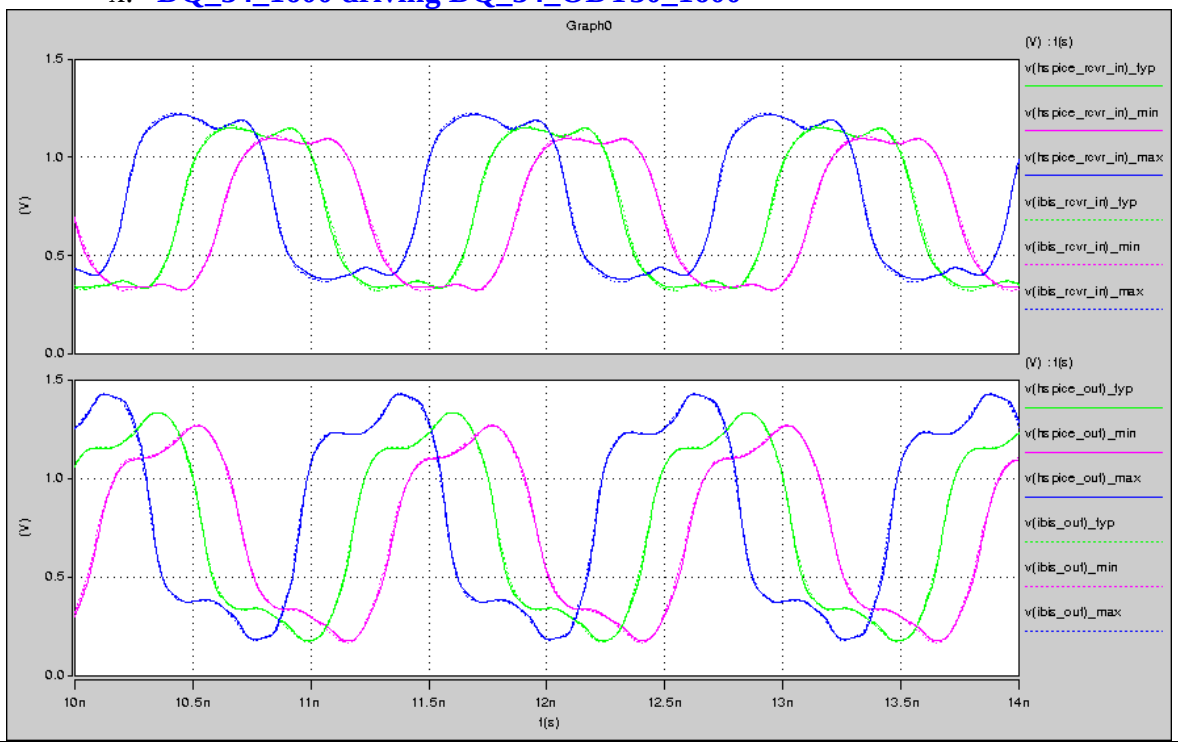
viii. **DQ_34_1600 driving DQ_34_1600**



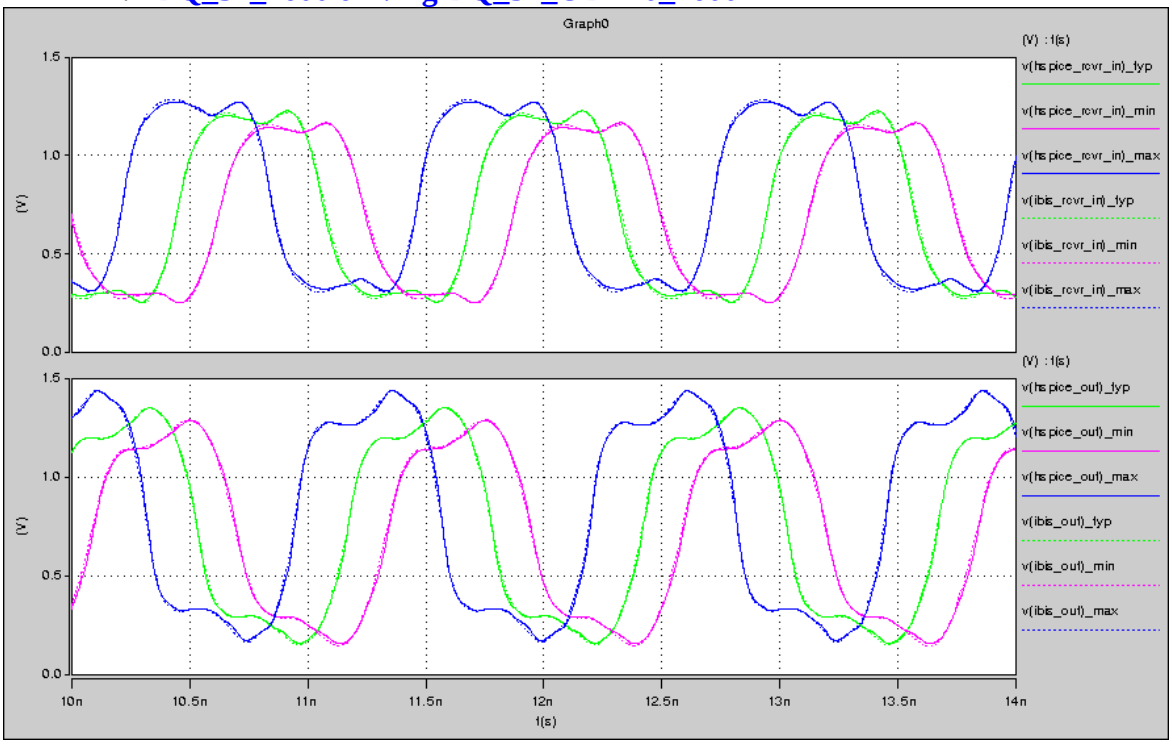
ix. **DQ_34_1600 driving DQ_34_ODT20_1600**



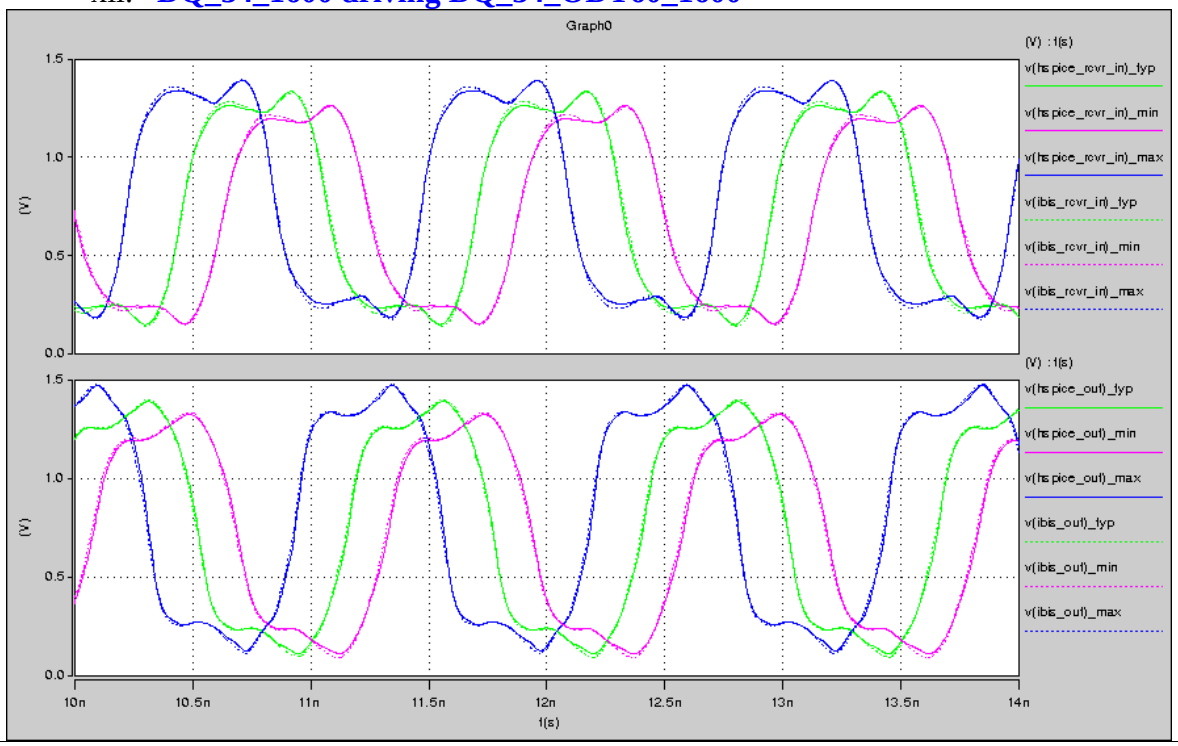
x. **DQ_34_1600 driving DQ_34_ODT30_1600**



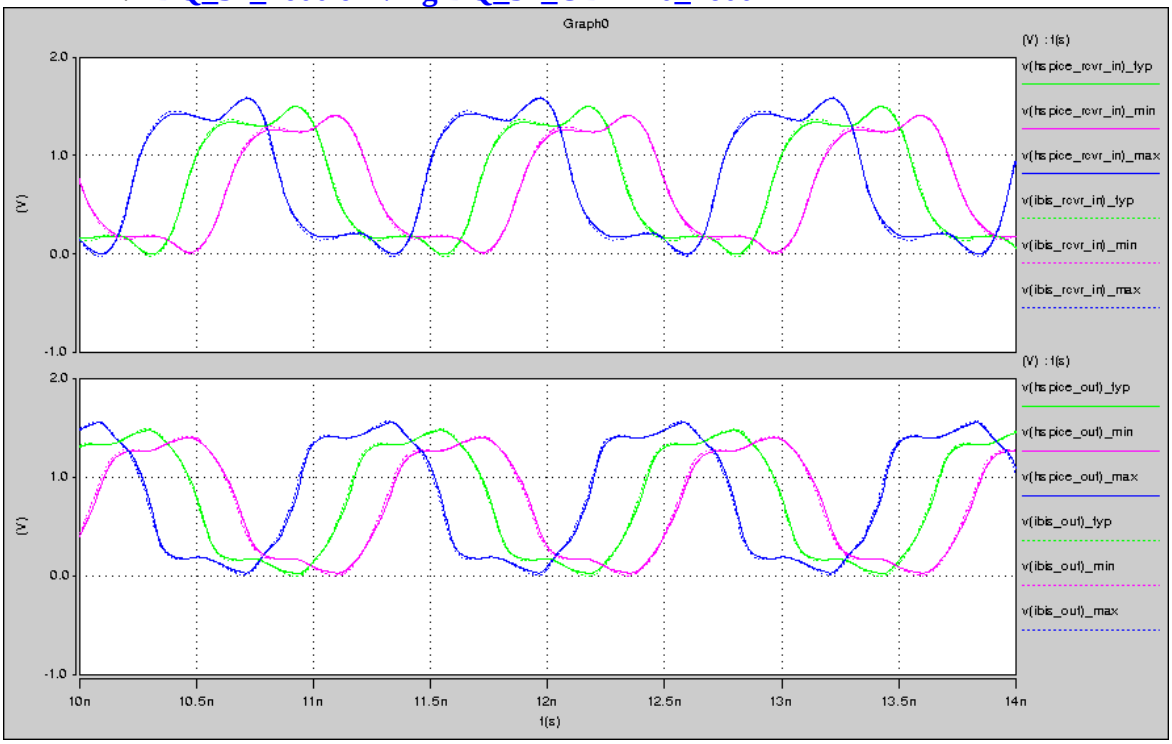
xi. **DQ_34_1600 driving DQ_34_ODT40_1600**



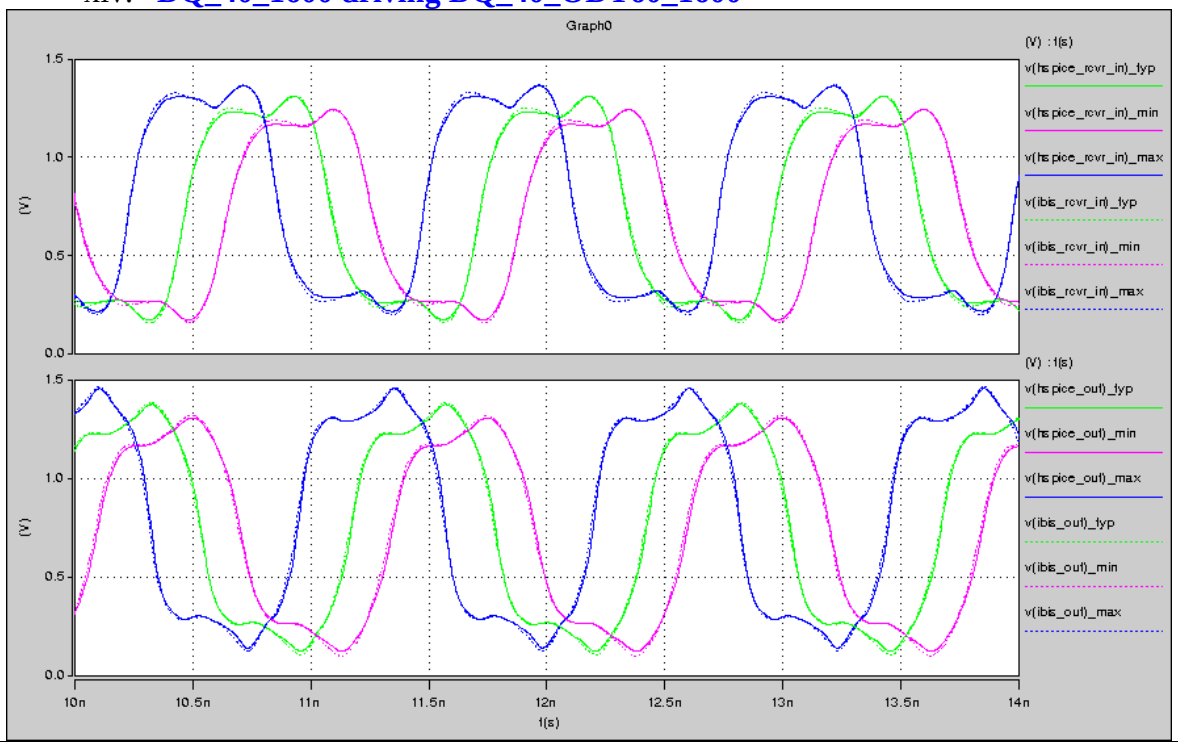
xii. **DQ_34_1600 driving DQ_34_ODT60_1600**



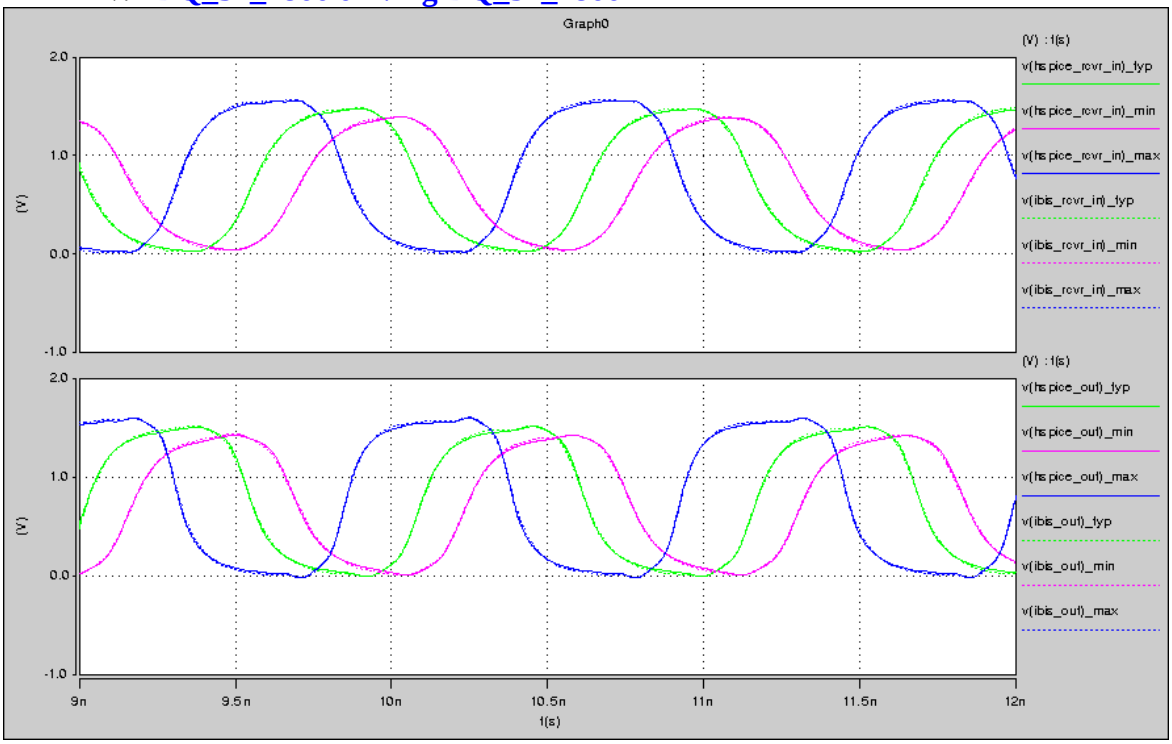
xiii. **DQ_34_1600 driving DQ_34_ODT120_1600**



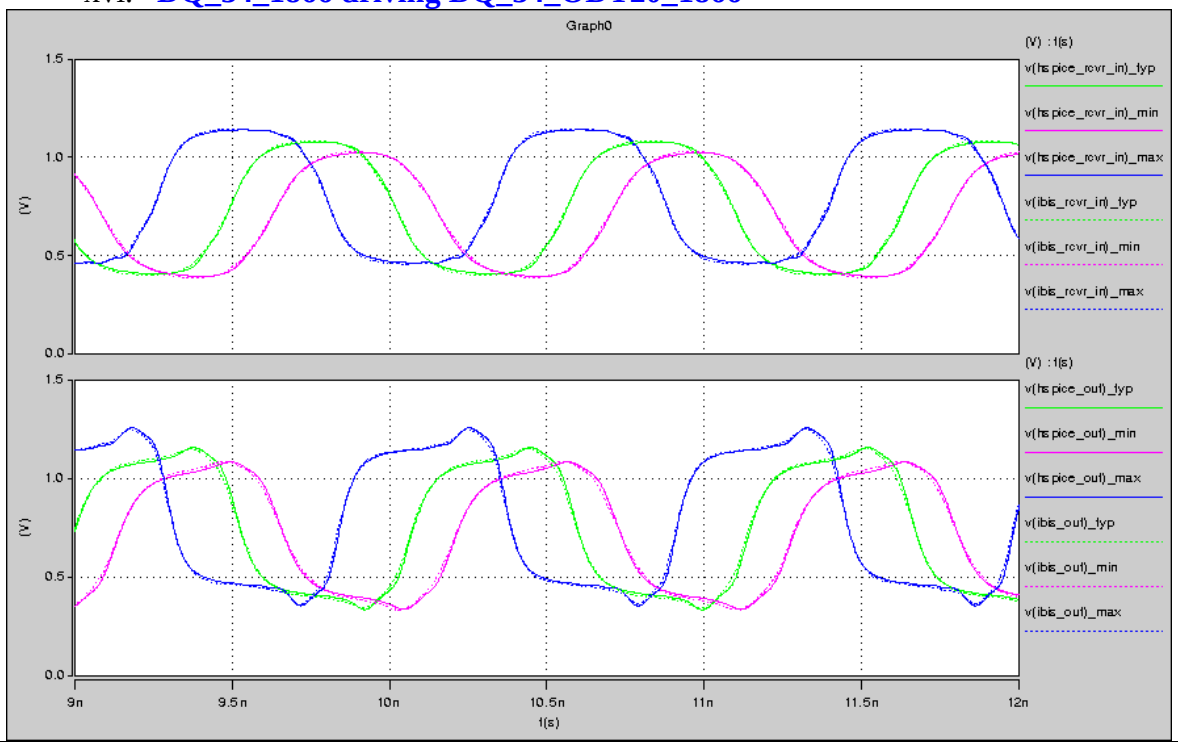
xiv. **DQ_40_1600 driving DQ_40_ODT60_1600**



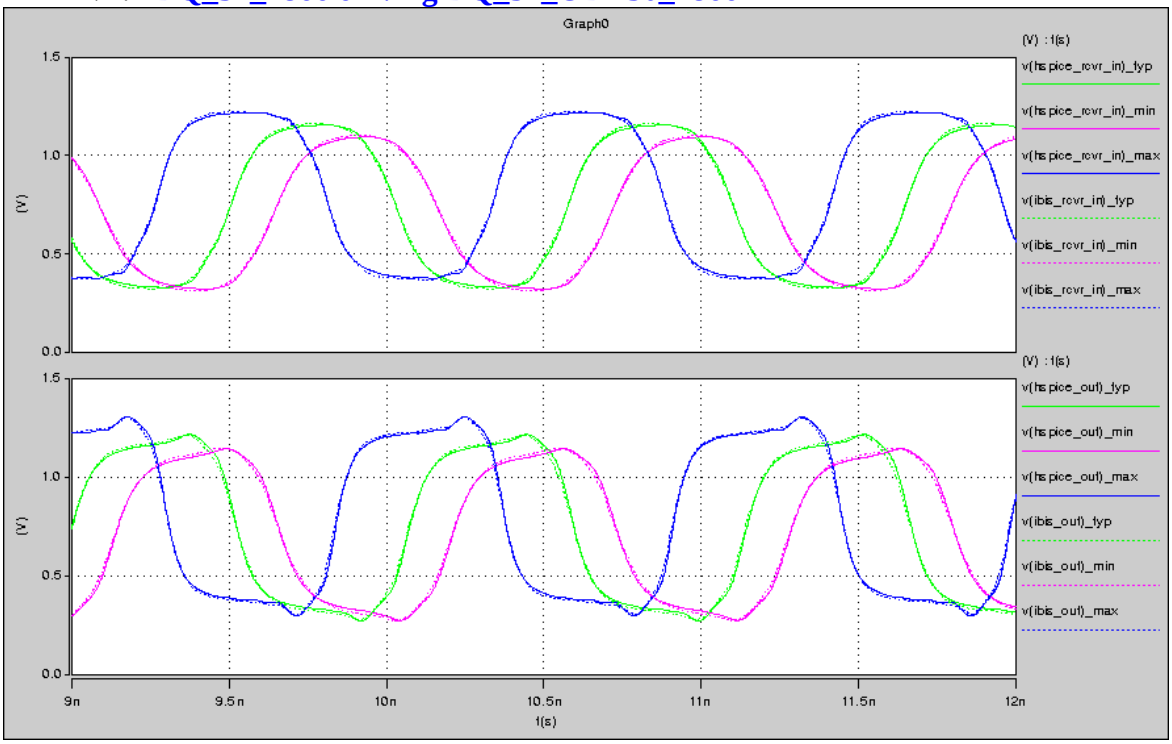
xv. **DQ_34_1866 driving DQ_34_1866**



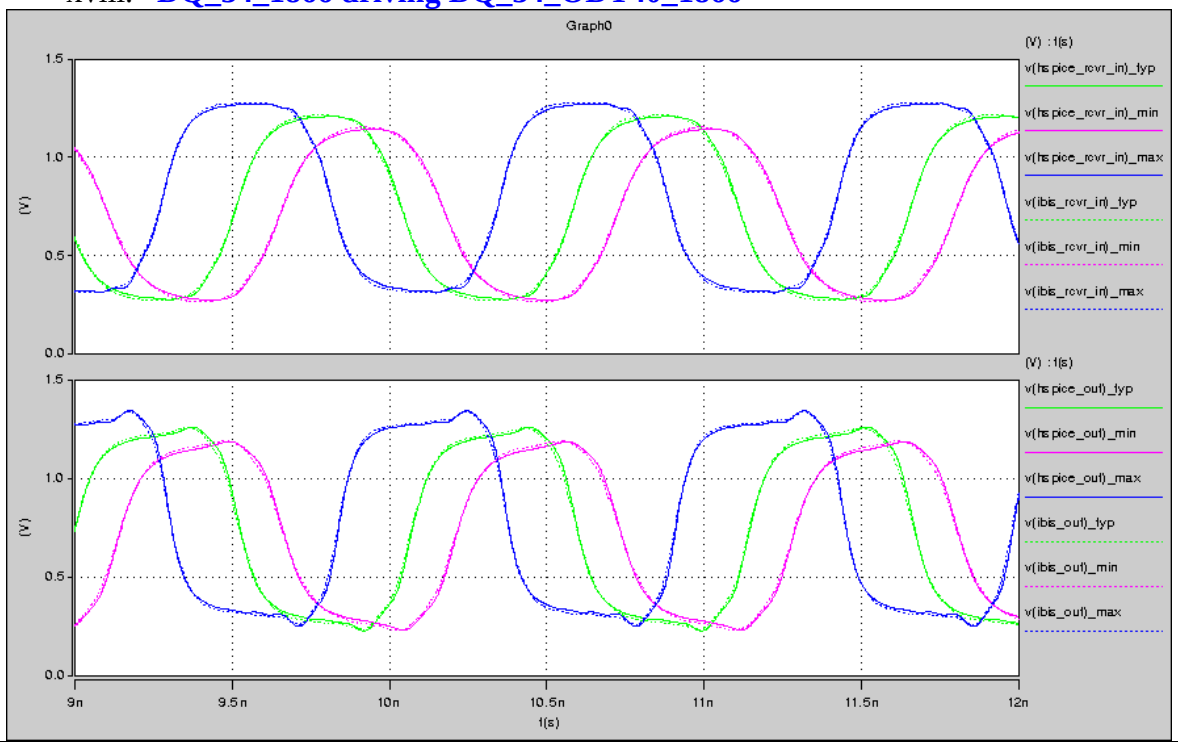
xvi. **DQ_34_1866 driving DQ_34_ODT20_1866**



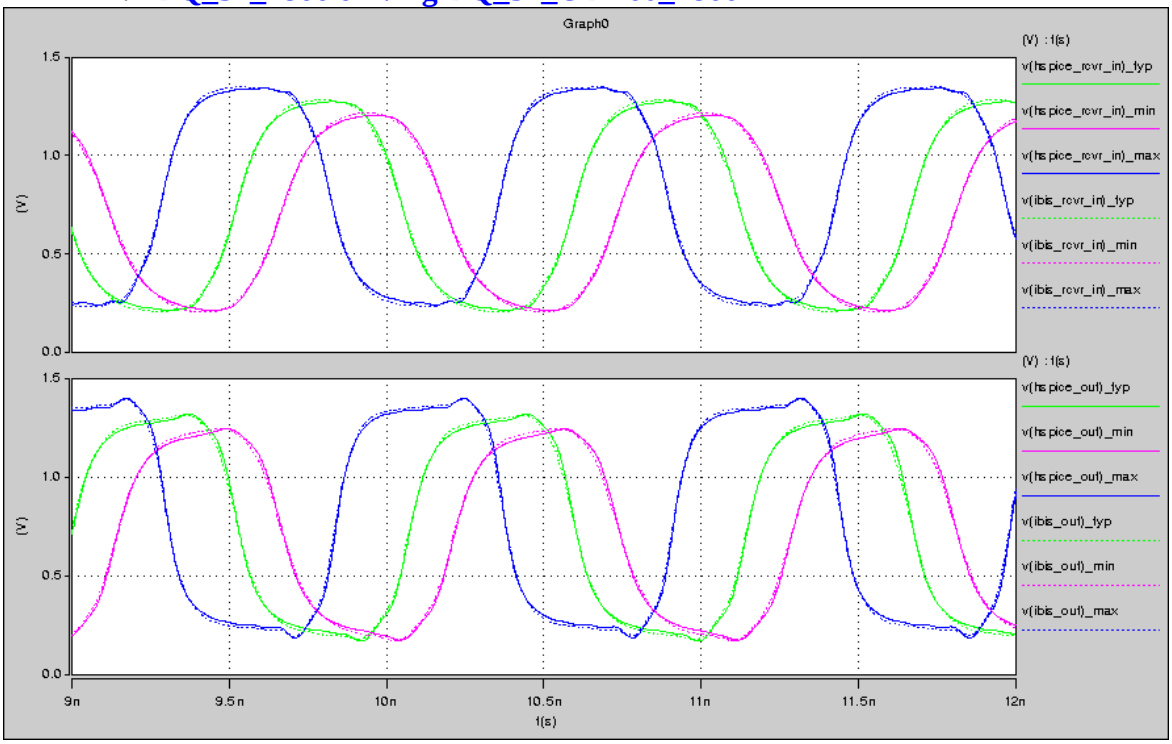
xvii. **DQ_34_1866 driving DQ_34_ODT30_1866**



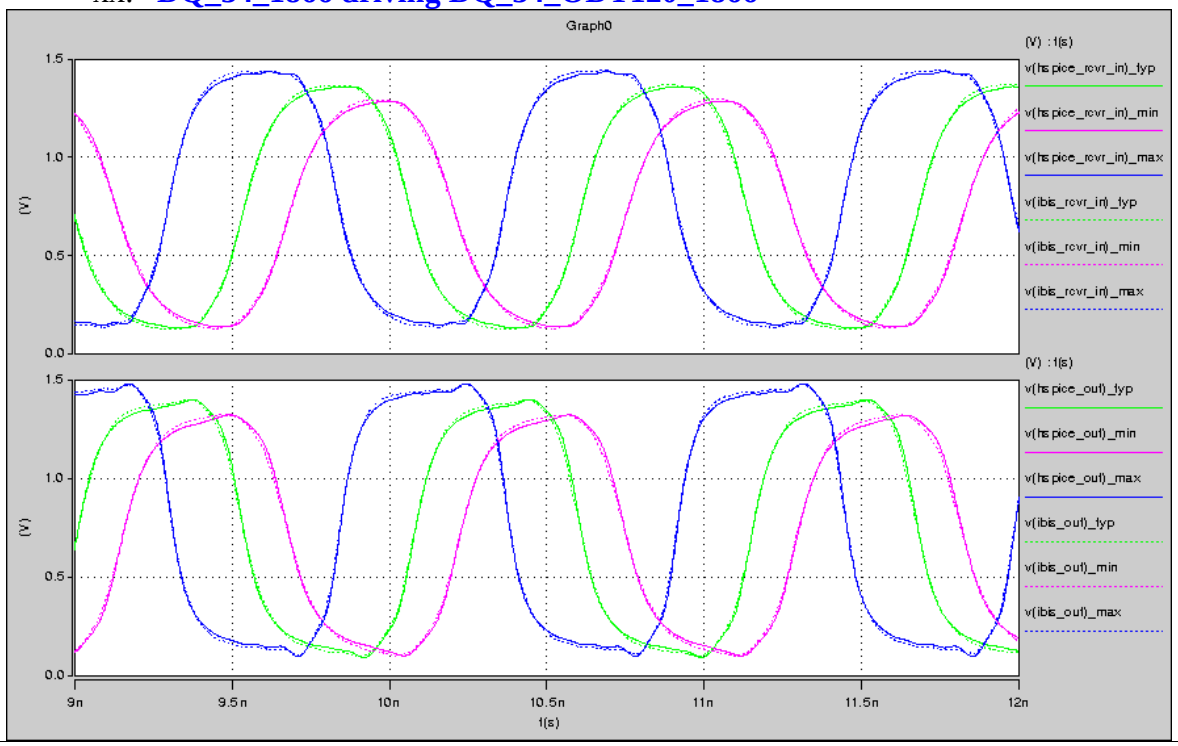
xviii. **DQ_34_1866 driving DQ_34_ODT40_1866**



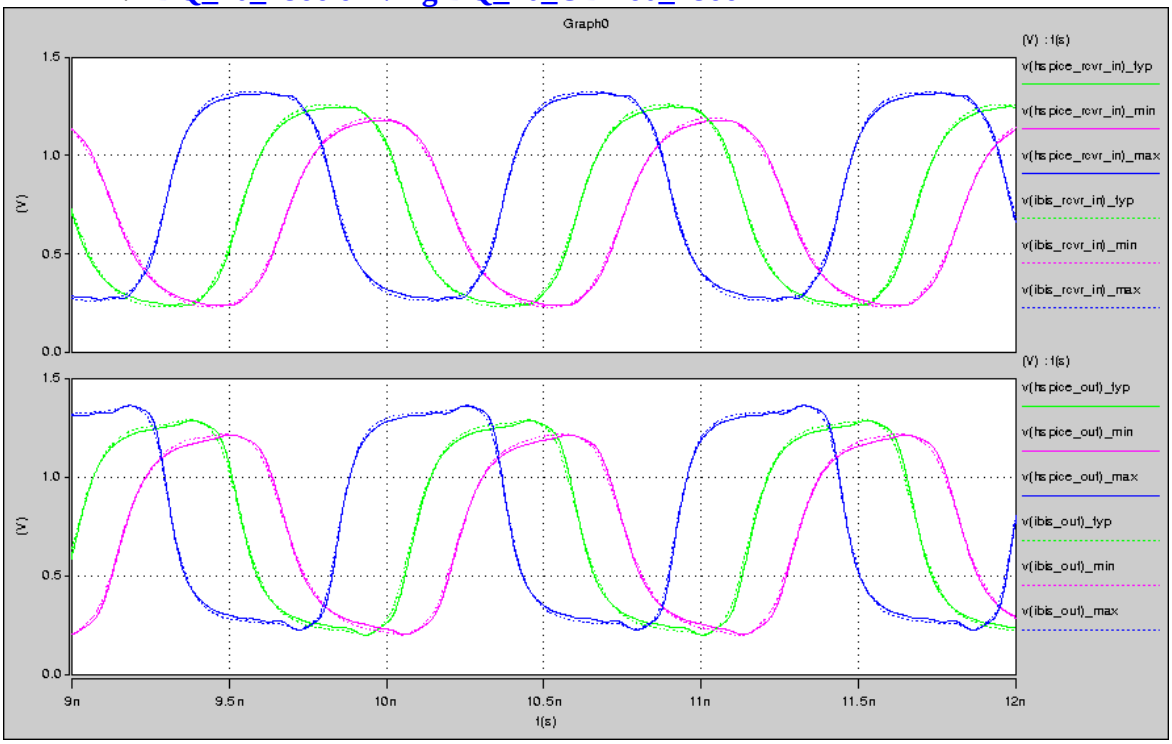
xix. **DQ_34_1866 driving DQ_34_ODT60_1866**



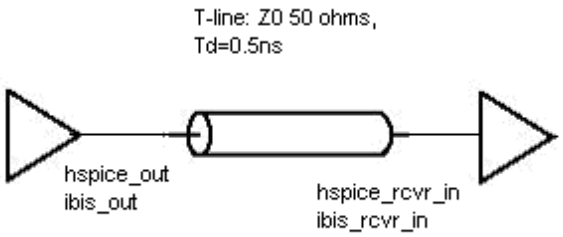
xx. **DQ_34_1866 driving DQ_34_ODT120_1866**



xxi. **DQ_40_1866 driving DQ_40_ODT60_1866**



Setup



Comments:

1. IBIS model may not reflect speed grade availability.
2. IBIS version is 4.2.
3. C_comp is compared with the DDR3-1600 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 1.5V 25C for typical corner, 1.425V 95C for minimum corner and 1.575V 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**

