
IBIS/HSPICE Model Quality Report

Design ID: **V88A**

Description: **1Gb DDR3 SDRAM**

Marketing device name(s): **MT41J256M4DA, MT41J128M8DA, MT41J64M16TW, MT41J256M4V88A, MT41J128M8V88A, MT41J64M16V88A**

Valid speed grades: **DDR3-1066, DDR3-1333, DDR3-1600, DDR3-1866, DDR3-2133** ¹

Zip filename: **v88a_at.zip**

IBIS filename: **v88a_ait.ibs, v88a_aat.ibs, v88a_aut.ibs** File rev: **2.0**

HSpice filename: **v88a_at_hspice.zip** File rev: **2.0**

EBD filename (if applicable): File rev:

Die rev: **J**

Date: **August 14, 2015**

Datasheet link: [http://www.micron.com/-](http://www.micron.com/-/media/Documents/Products/Data%20Sheet/DRAM/DDR3/1Gb_DDR3_SDRAM.pdf)

[/media/Documents/Products/Data%20Sheet/DRAM/DDR3/1Gb_DDR3_SDRAM.pdf](http://www.micron.com/-/media/Documents/Products/Data%20Sheet/DRAM/DDR3/1Gb_DDR3_SDRAM.pdf)

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

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

Junction Temperature (Automotive Ultra-high) - Slow: **140C** Typical: **50C** Fast: **-40C**

VDDQ/VSSQ Decoupling Capacitance: **11.11nF**

Included in HSPICE DQ/DQS models? **Yes** Amount per DQ/DQS model: **505pF/1010pF**

VDDQ/VSSQ Decoupling Capacitance Series Resistance: **~2ohms**

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: **v88a_at_ibis_quality_checklist.xls**

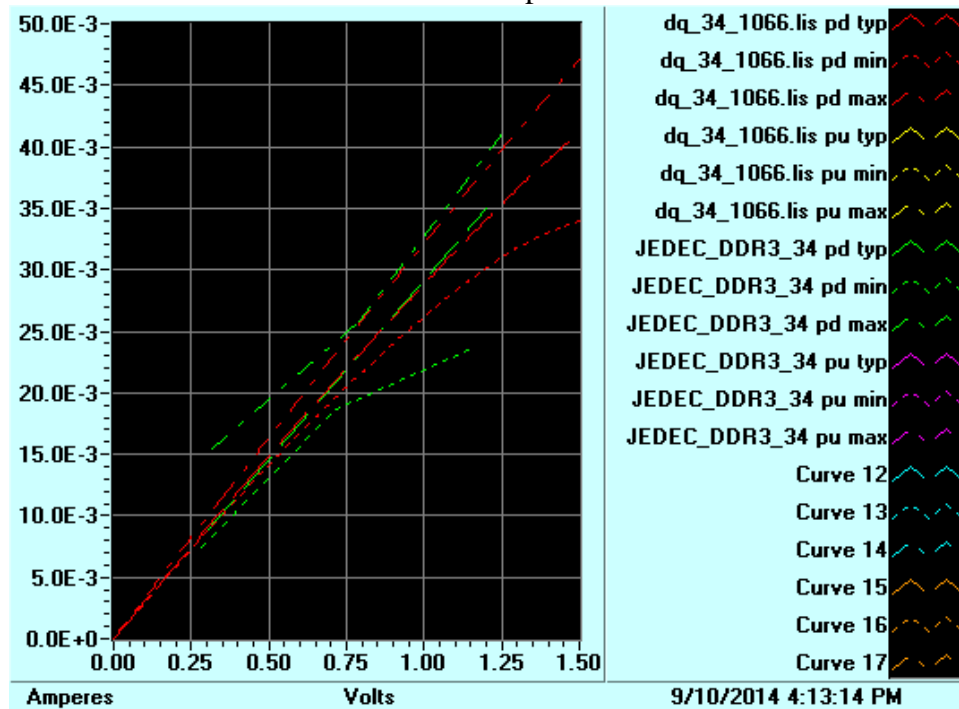
IBIS MODEL Correlation

Datasheet Correlation

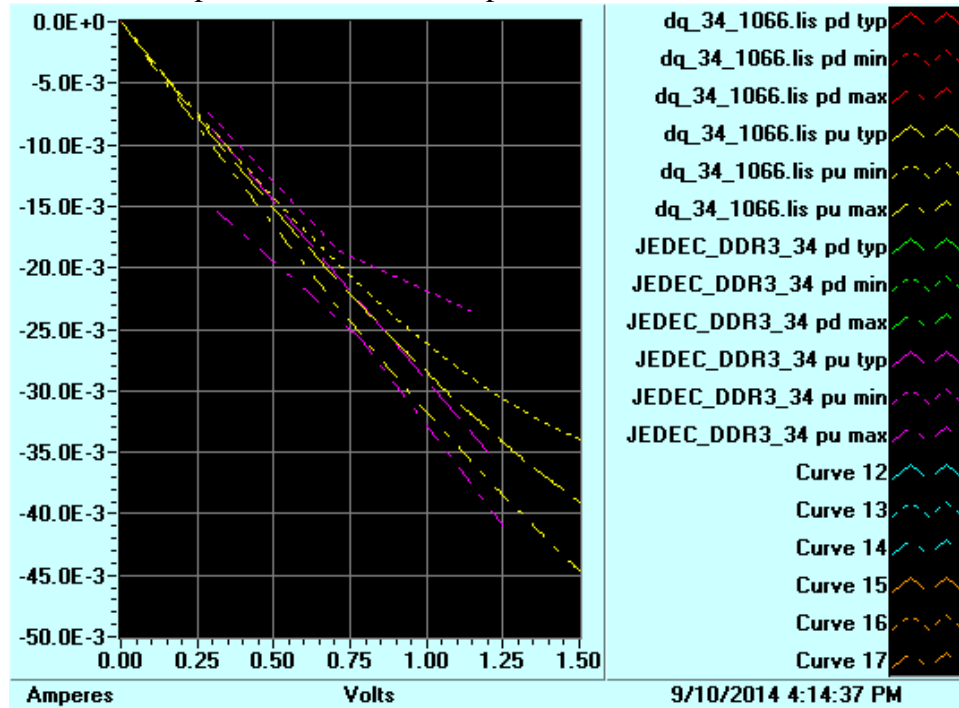
1. ☒ For Output or I/O model compare datasheet IOH/IOL data with IBIS pullup/pulldown data.

a. Model name: **DQ_34_1066**

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

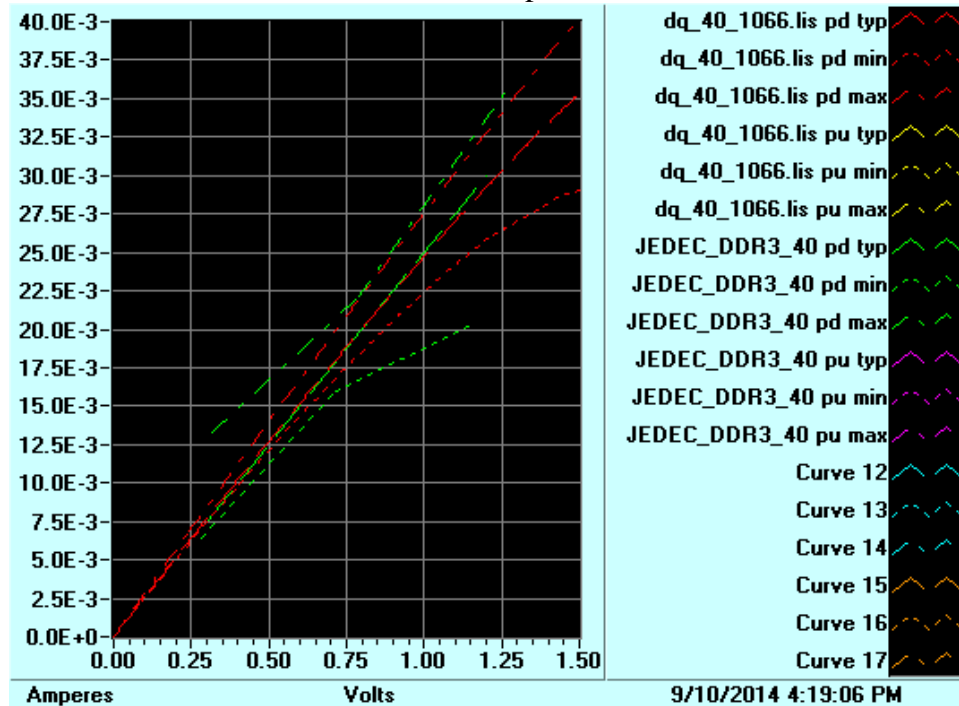


ii. Pullup I-V versus JEDEC specification

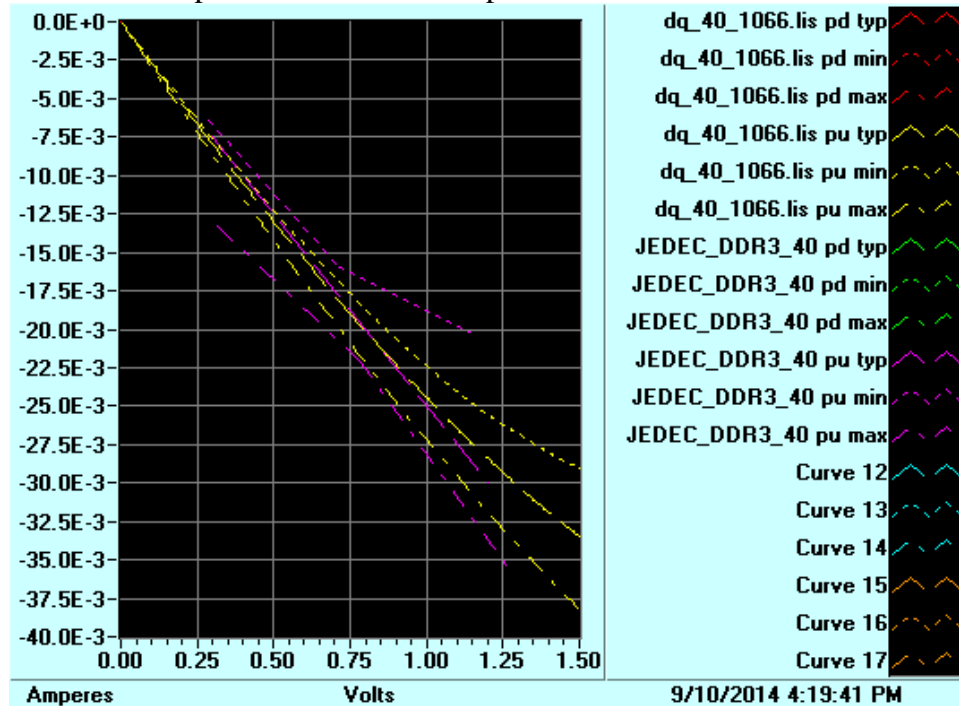


b. Model name: **DQ_40_1066**

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: **MT41J256M4DA, MT41J128M8DA (78b, x4/x8)**

		IBIS (pF)		Datasheet (pF)	
		min	max	min	max
DQ	C_comp	1.225	1.375	NA	NA
	C package	0.378	0.556	NA	NA
	C_total	1.603	1.931	1.50	2.30
INPUT1	C_comp	0.635	0.785	NA	NA
	C package	0.362	0.447	NA	NA
	C_total	0.997	1.232	0.75	1.30
INPUT2	C_comp	0.675	0.825	NA	NA
	C package	0.268	0.366	NA	NA
	C_total	0.943	1.191	0.75	1.30
CLK	C_comp	0.625	0.775	NA	NA
	C package	0.332	0.357	NA	NA
	C_total	0.957	1.132	0.80	1.40
RST	C_comp	0.635	0.785	NA	NA
	C package	0.496	0.496	NA	NA
	C_total	1.131	1.281	NA	3.00

Component name: **MT41J64M16TW (96b, x16)**

		IBIS (pF)		Datasheet (pF)	
		min	max	min	max
DQ	C_comp	1.225	1.375	NA	NA
	C package	0.335	0.485	NA	NA
	C_total	1.560	1.860	1.50	2.30
INPUT1	C_comp	0.635	0.785	NA	NA
	C package	0.388	0.476	NA	NA
	C_total	1.023	1.261	0.75	1.30
INPUT2	C_comp	0.675	0.825	NA	NA
	C package	0.322	0.416	NA	NA
	C_total	0.997	1.241	0.75	1.30
CLK	C_comp	0.625	0.775	NA	NA
	C package	0.320	0.323	NA	NA
	C_total	0.945	1.098	0.80	1.40
RST	C_comp	0.635	0.785	NA	NA
	C package	0.517	0.517	NA	NA
	C_total	1.152	1.302	NA	3.00

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	4.96	6.74	8.69	2.50	6.00
	Falling	4.82	6.23	7.63	2.50	6.00
DQ_40_1066	Rising	4.30	5.90	7.77	2.50	6.00
	Falling	4.22	5.53	6.92	2.50	6.00
DQ_34_1600	Rising	4.85	6.59	8.52	2.50	6.00
	Falling	4.73	6.20	7.48	2.50	6.00
DQ_40_1600	Rising	4.23	5.89	7.68	2.50	6.00
	Falling	4.15	5.55	6.77	2.50	6.00
DQ_34_1866	Rising	4.98	6.74	8.70	2.50	6.00
	Falling	4.83	6.26	7.62	2.50	6.00
DQ_40_1866	Rising	4.32	5.96	7.83	2.50	6.00
	Falling	4.22	5.58	6.90	2.50	6.00
DQ_34_2133	Rising	6.02	6.77	8.72	2.50	6.00
	Falling	5.33	6.30	7.61	2.50	6.00
DQ_40_2133	Rising	5.30	5.99	7.82	2.50	6.00
	Falling	4.72	5.60	6.91	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
Ivil (A)	-8.24E-03	-7.35E-03	-9.17E-03
Ivih (A)	8.15E-03	7.16E-03	9.31E-03
	TYP	MAX	MIN
Rtt (Model)	21.36	24.13	18.93
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
Ivil (A)	-5.50E-03	-4.92E-03	-6.12E-03
Ivih (A)	5.45E-03	4.79E-03	6.21E-03
	TYP	MAX	MIN
Rtt (Model)	31.96	36.05	28.38
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)	-4.15E-03	-3.69E-03	-4.59E-03
Ivih (A)	4.09E-03	3.59E-03	4.65E-03
	TYP	MAX	MIN
Rtt (Model)	42.49	48.12	37.86
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)	-2.75E-03	-2.48E-03	-3.05E-03
Ivih (A)	2.72E-03	2.41E-03	3.10E-03
	TYP	MAX	MIN
Rtt (Model)	64.01	71.56	56.90
Rtt (datasheet-in units of ZQ/12)	1.0	1.6	0.9
Rtt (datasheet)	60	96	54

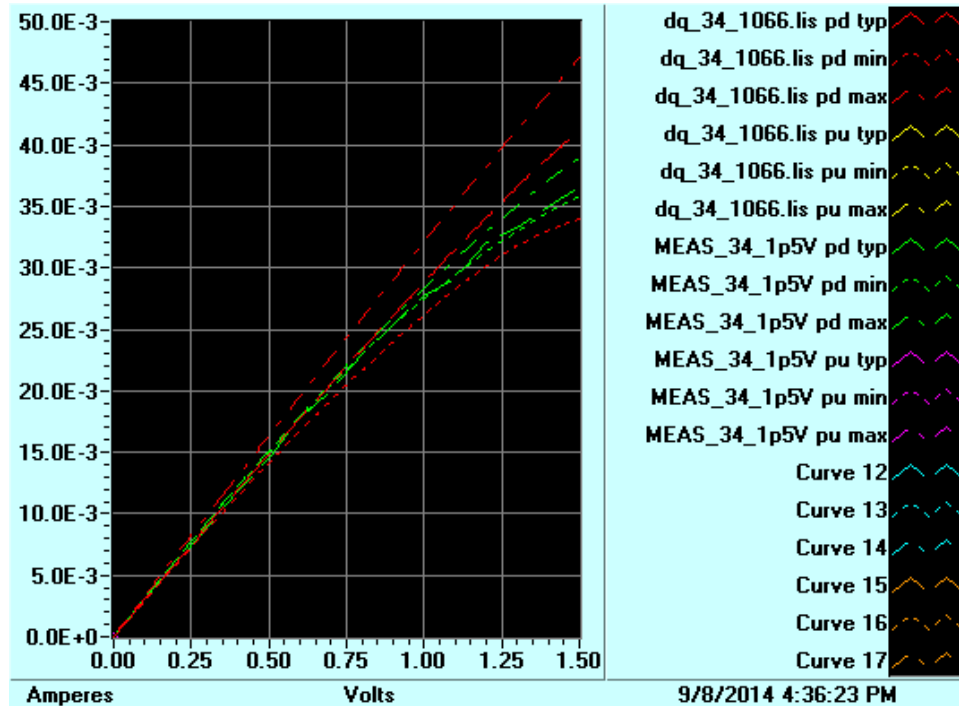
ODT120	TYP	MIN	MAX
Vil (V)	0.575	0.5375	0.6125
Vih (V)	0.925	0.8875	0.9625
Ivil (A)	-1.38E-03	-1.24E-03	-1.53E-03
Ivih (A)	1.36E-03	1.20E-03	1.55E-03
	TYP	MAX	MIN
Rtt (Model)	127.59	143.65	113.92
Rtt (datasheet-in units of ZQ/12)	1.0	1.6	0.9
Rtt (datasheet)	120	192	108

Measurement Correlation

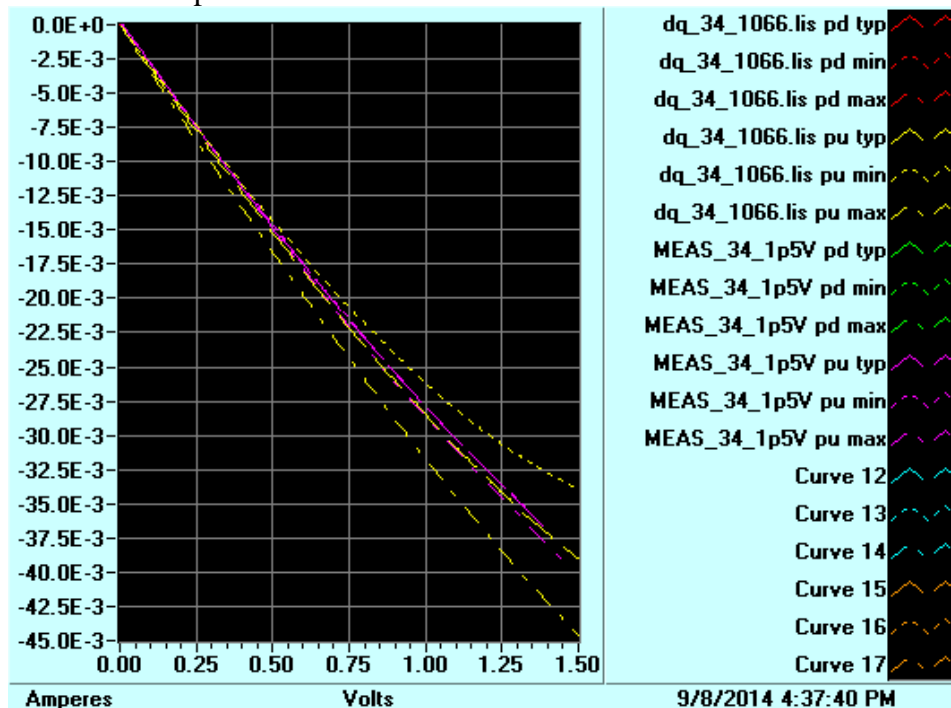
1. ☒ For Output or I/O models compare measured IOH/IOL data with IBIS pullup/pulldown data. If the measurement conditions are different than the IBIS conditions, run Spice simulations using the same measurement conditions such as VCC, temperature, and process. Include measurement conditions in the image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

a. Model name: **DQ_34_1066**

i. Pulldown I-V versus Measurement

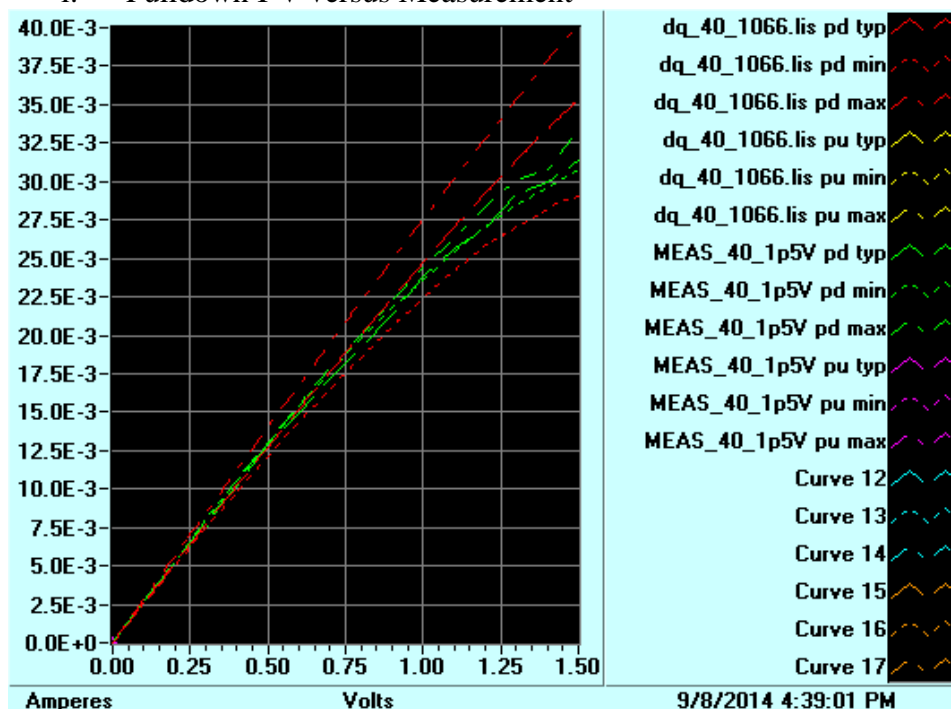


ii. Pullup I-V versus Measurement

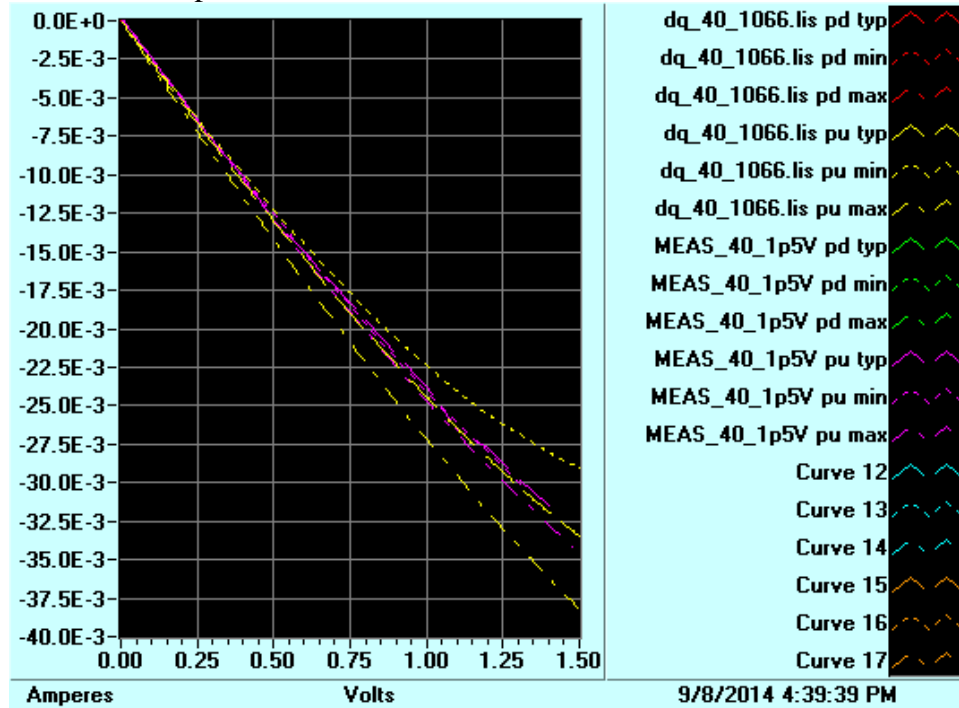


b. Model name: **DQ_40_1066**

i. Pulldown I-V versus Measurement



ii. Pullup I-V versus Measurement



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: **MT41J256M4DA, MT41J128M8DA (78b, x4/x8)**

		IBIS (pF)			Measured (pF)		
		min	typ	max	min	typ	max
DQ	C_comp	1.225	1.300	1.375	NA	NA	NA
	C package	0.378	0.445	0.556	NA	NA	NA
	C_total	1.603	1.745	1.931	1.680	1.760	1.880
INPUT1	C_comp	0.635	0.710	0.785	NA	NA	NA
	C package	0.362	0.406	0.447	NA	NA	NA
	C_total	0.997	1.116	1.232	1.040	1.109	1.170
INPUT2	C_comp	0.675	0.750	0.825	NA	NA	NA
	C package	0.268	0.327	0.366	NA	NA	NA
	C_total	0.943	1.077	1.191	1.030	1.085	1.150
CLK	C_comp	0.625	0.700	0.775	NA	NA	NA
	C package	0.332	0.345	0.357	NA	NA	NA
	C_total	0.957	1.045	1.132	1.040	1.050	1.060
RST	C_comp	0.635	0.710	0.785	NA	NA	NA
	C package	0.496	0.496	0.496	NA	NA	NA
	C_total	1.131	1.206	1.281	1.170	1.180	1.190

Component name: **MT41J64M16TW (96b, x16)**

		IBIS (pF)			Measured (pF)		
		min	typ	max	min	typ	max
DQ	C_comp	1.225	1.300	1.375	NA	NA	NA
	C package	0.335	0.404	0.485	NA	NA	NA
	C_total	1.560	1.704	1.860	1.620	1.700	1.840
INPUT1	C_comp	0.635	0.710	0.785	NA	NA	NA
	C package	0.388	0.432	0.476	NA	NA	NA
	C_total	1.023	1.142	1.261	1.060	1.140	1.230
INPUT2	C_comp	0.675	0.750	0.825	NA	NA	NA
	C package	0.322	0.360	0.416	NA	NA	NA
	C_total	0.997	1.110	1.241	1.040	1.110	1.200
CLK	C_comp	0.625	0.700	0.775	NA	NA	NA
	C package	0.320	0.322	0.323	NA	NA	NA
	C_total	0.945	1.022	1.098	0.970	0.990	1.000
RST	C_comp	0.635	0.710	0.785	NA	NA	NA
	C package	0.517	0.517	0.517	NA	NA	NA
	C_total	1.152	1.227	1.302	1.240	1.250	1.260

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3. ☐ If measured clamp current data is available, provide an IBIS versus measurement comparison for all models. Include measurement conditions in the image labels.

Not Available

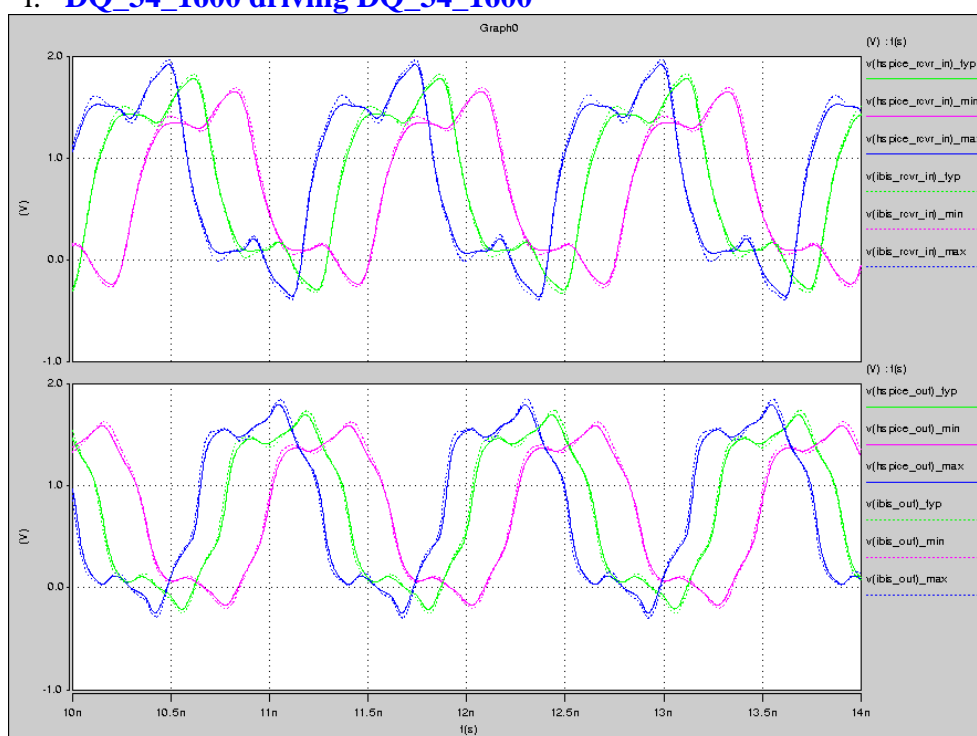
4. ☐ If slew rate data (rise/fall slew) is available from measurements, complete Spice simulations to generate slew rate data and provide a comparison table.

Not Available

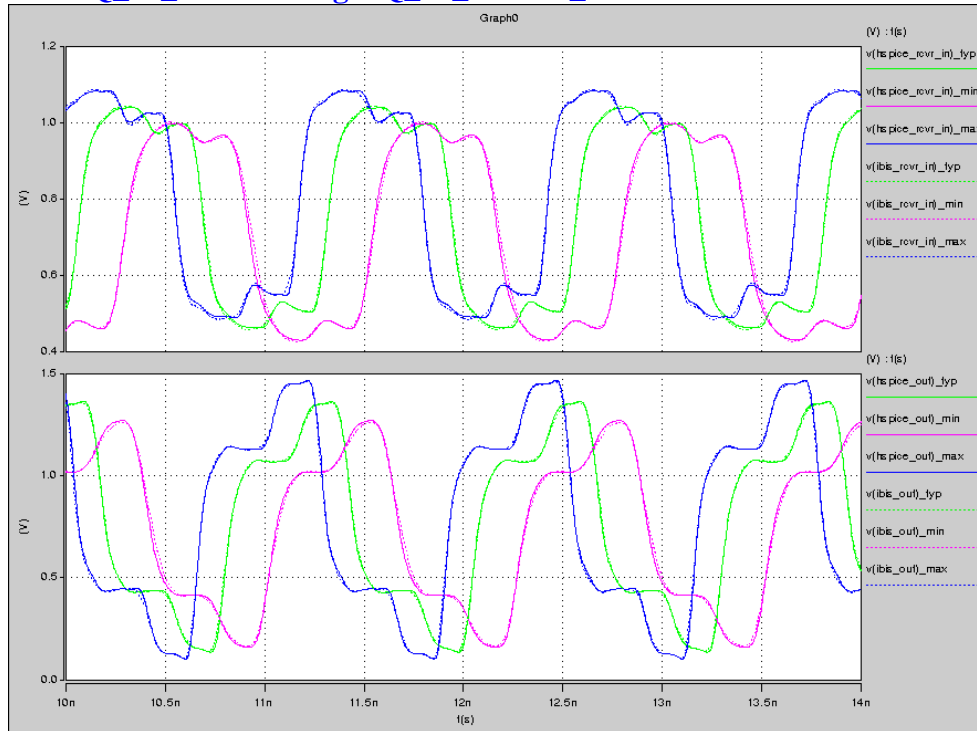
IBIS vs Spice Correlation

1. ☒ For all Output or I/O models, run Spice 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 Spice files. Update the setup diagram if it is different. Indicate the version of Spice simulator used for simulations: **2012.06**
 - b. ☒ Run simulations for all corners cases and at fastest speed grades, testing ODT models as loads when applicable.

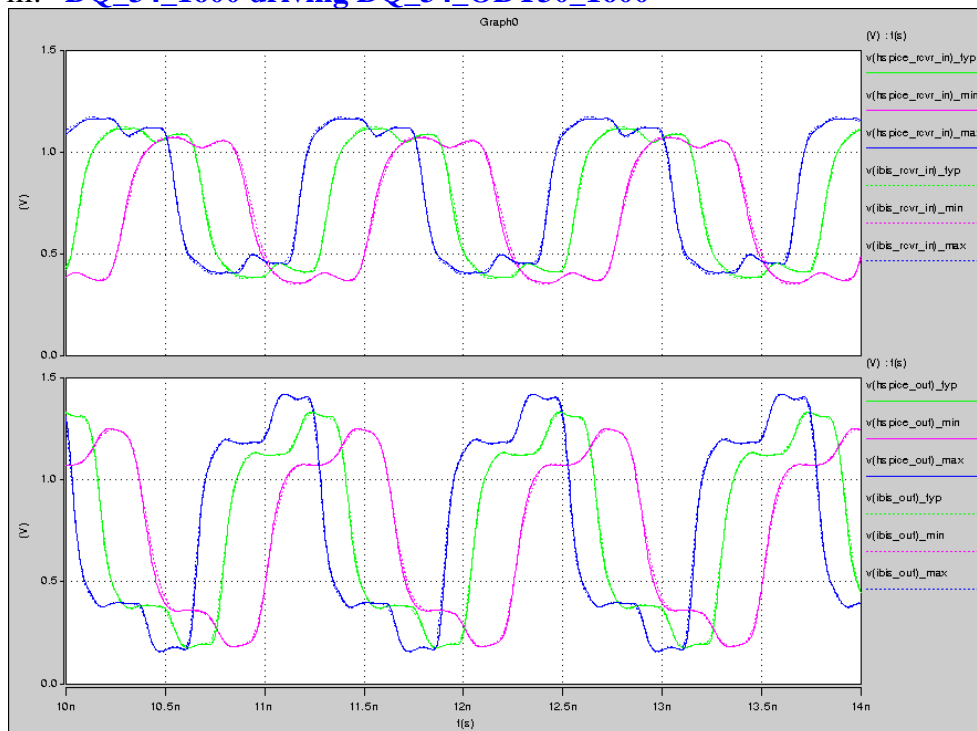
i. DQ_34_1600 driving DQ_34_1600



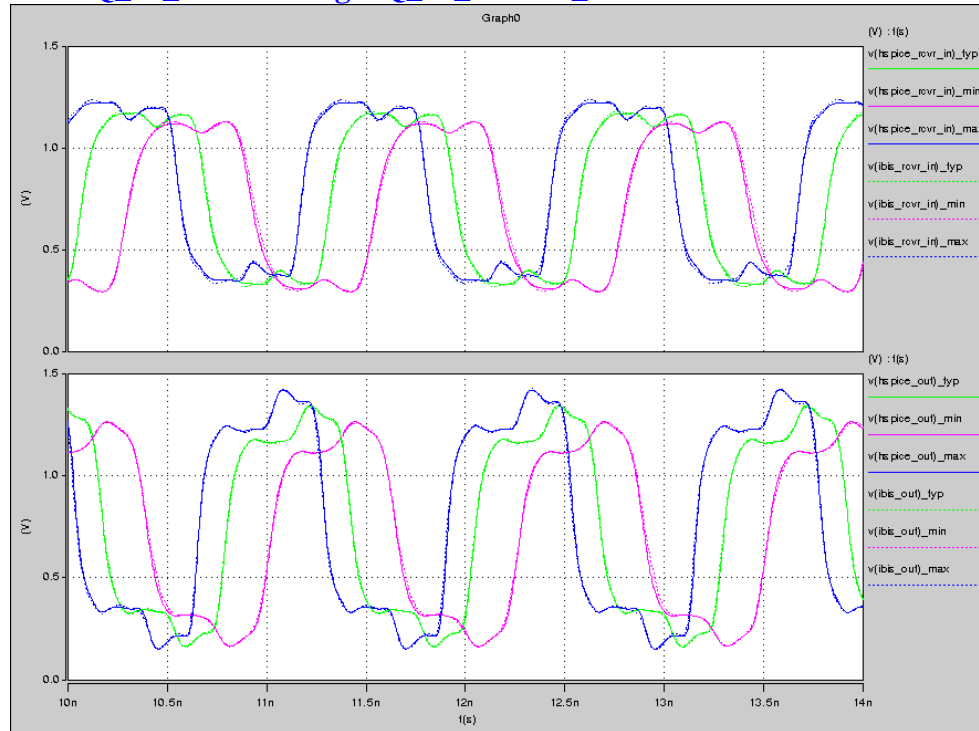
ii. **DQ_34_1600 driving DQ_34_ODT20_1600**



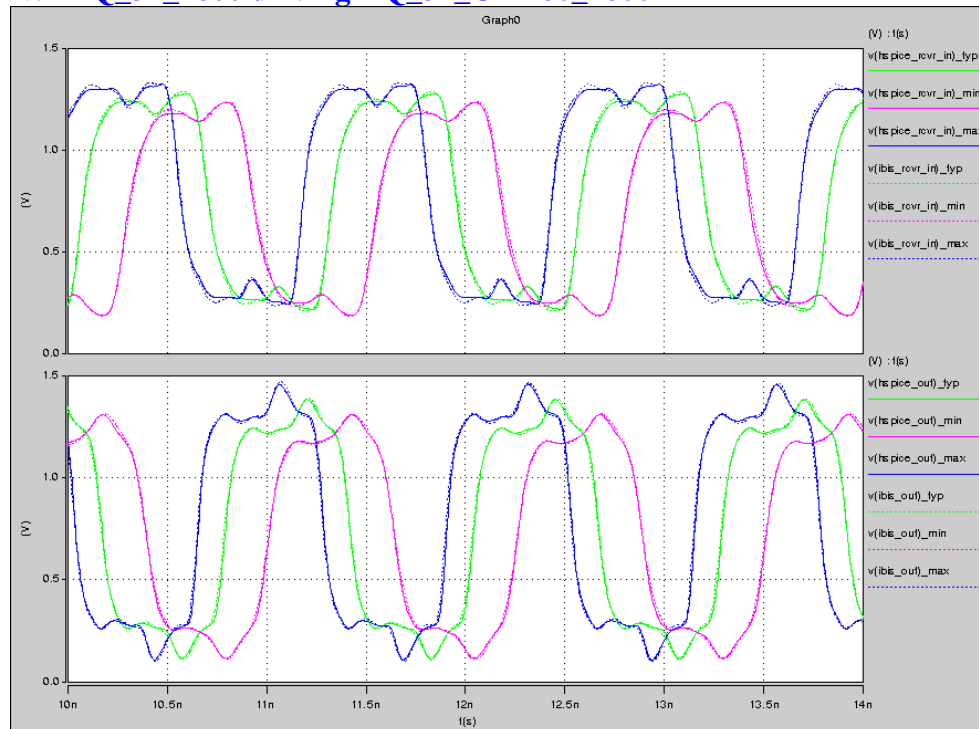
iii. **DQ_34_1600 driving DQ_34_ODT30_1600**



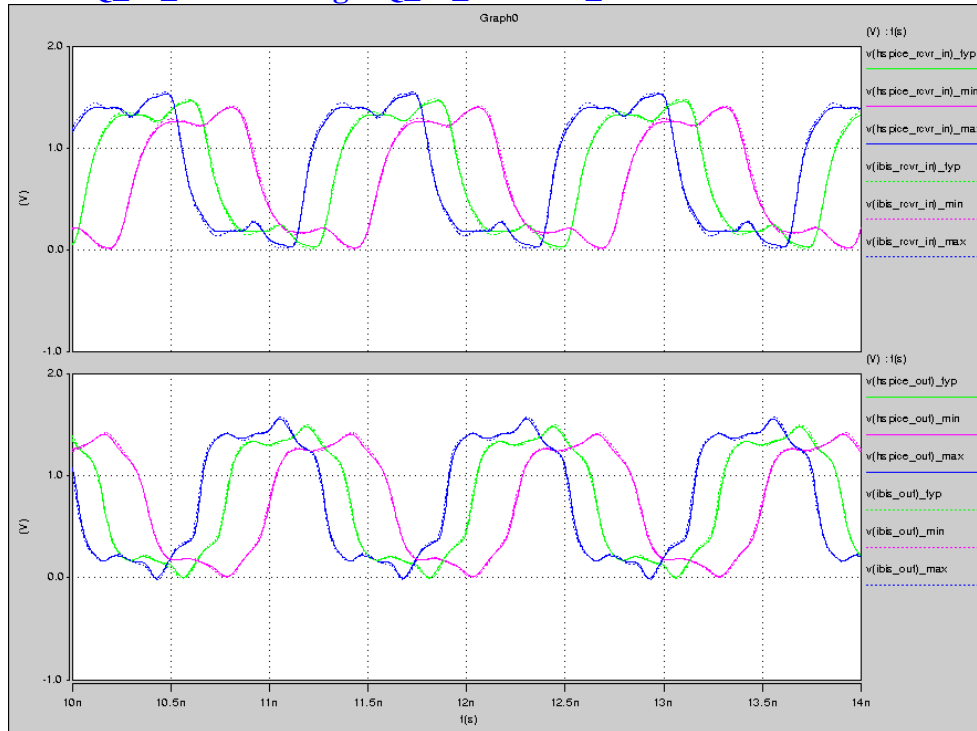
iv. **DQ_34_1600 driving DQ_34_ODT40_1600**



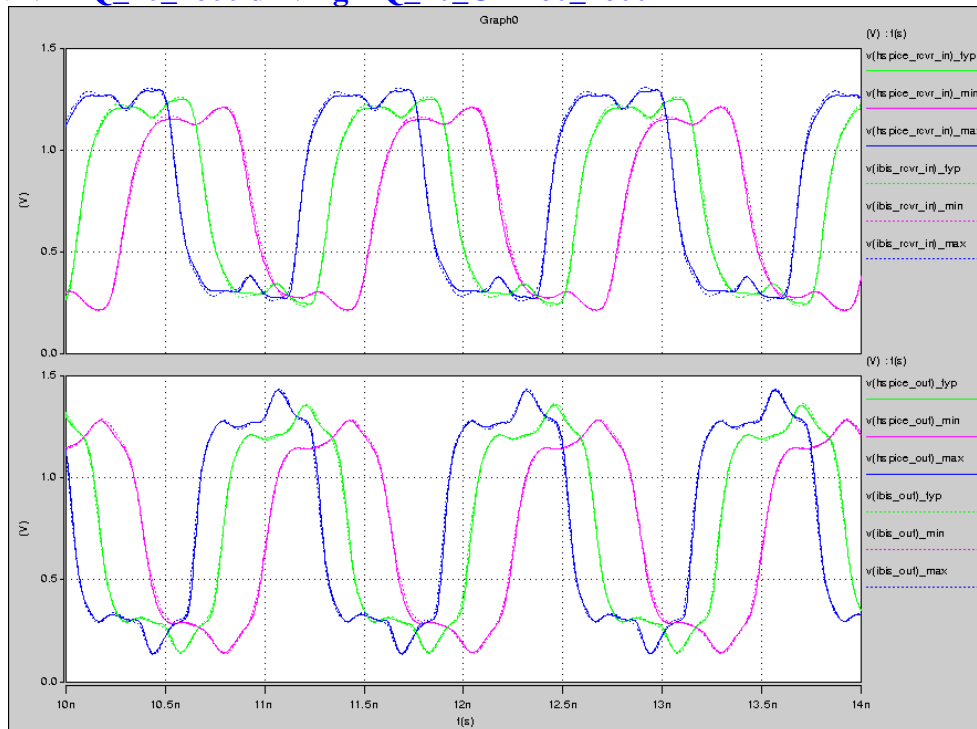
v. **DQ_34_1600 driving DQ_34_ODT60_1600**



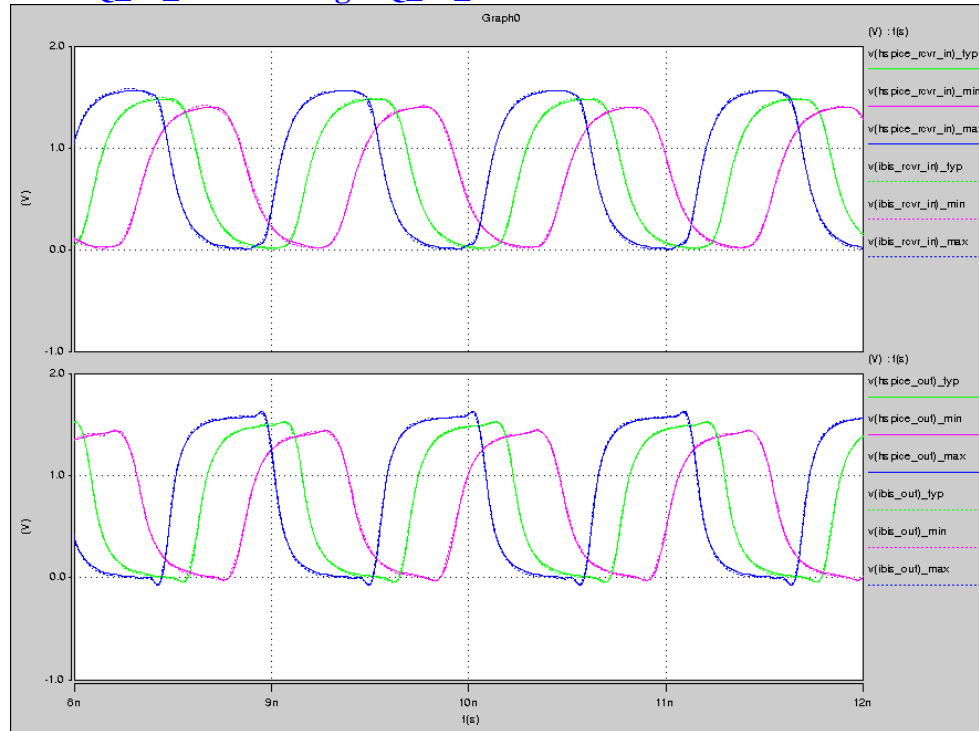
vi. **DQ_34_1600 driving DQ_34_ODT120_1600**



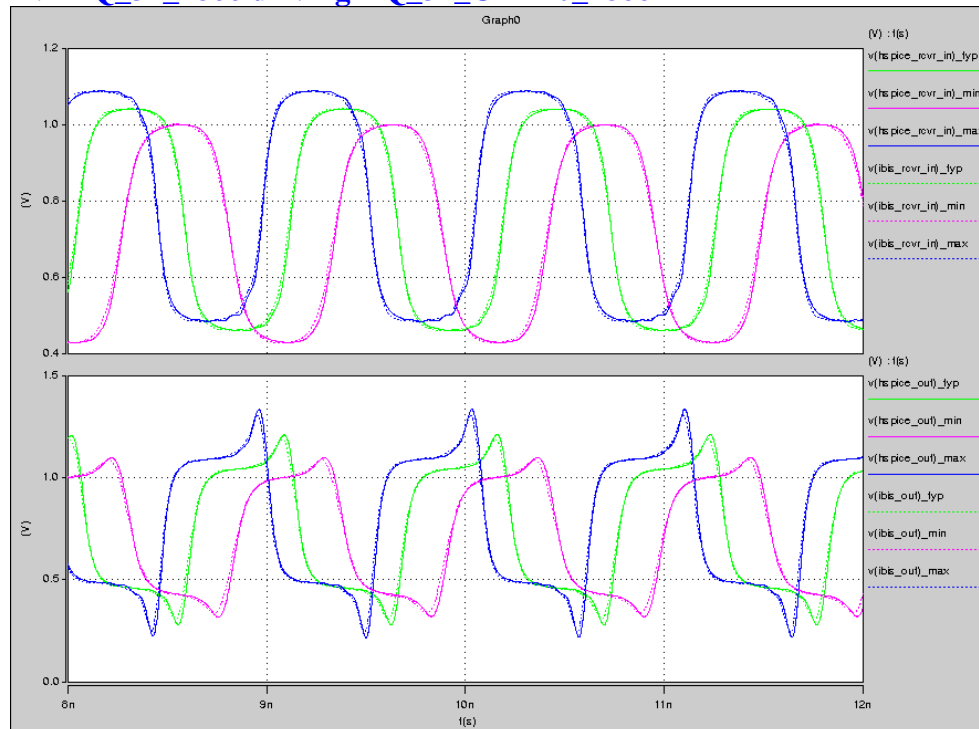
vii. **DQ_40_1600 driving DQ_40_ODT60_1600**



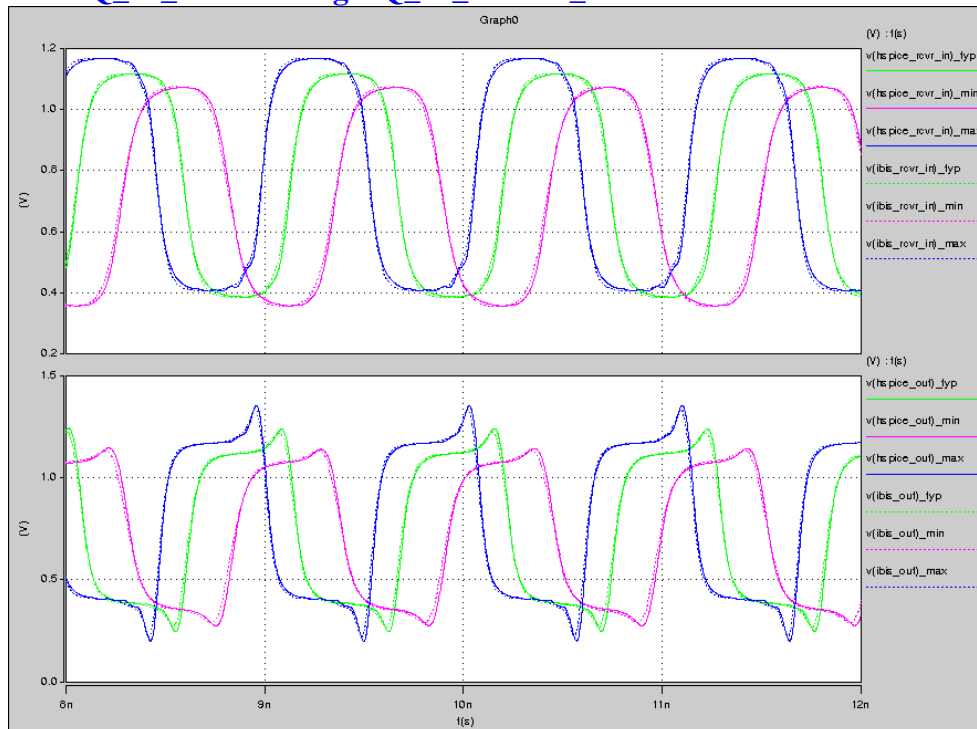
viii. **DQ_34_1866 driving DQ_34_1866**



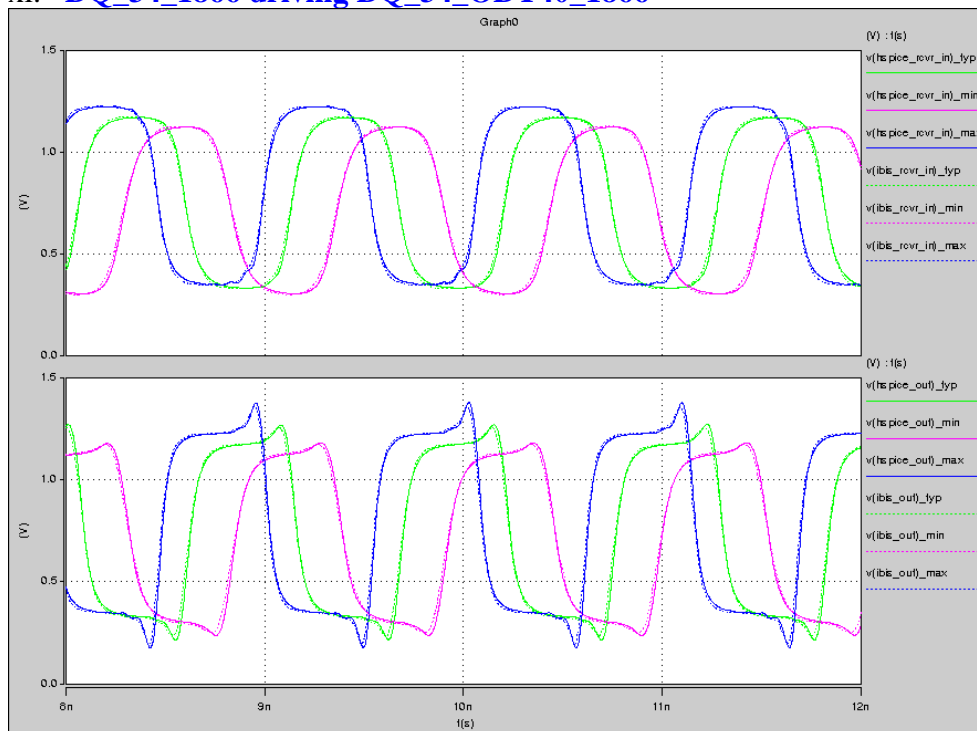
ix. **DQ_34_1866 driving DQ_34_ODT20_1866**



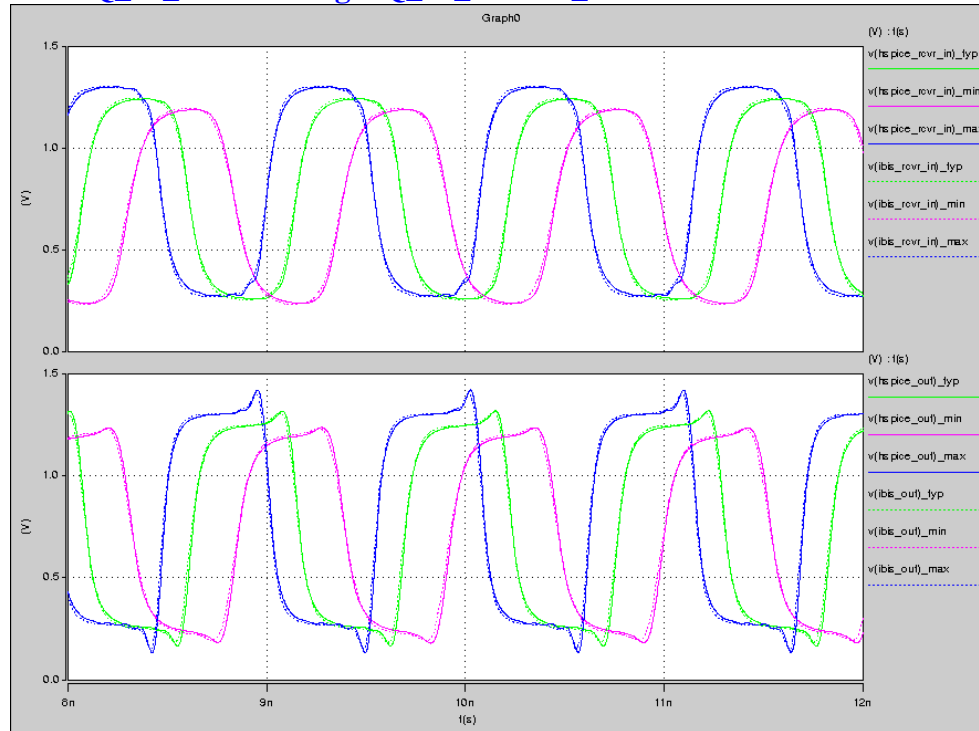
X. DQ_34_1866 driving DQ_34_ODT30_1866



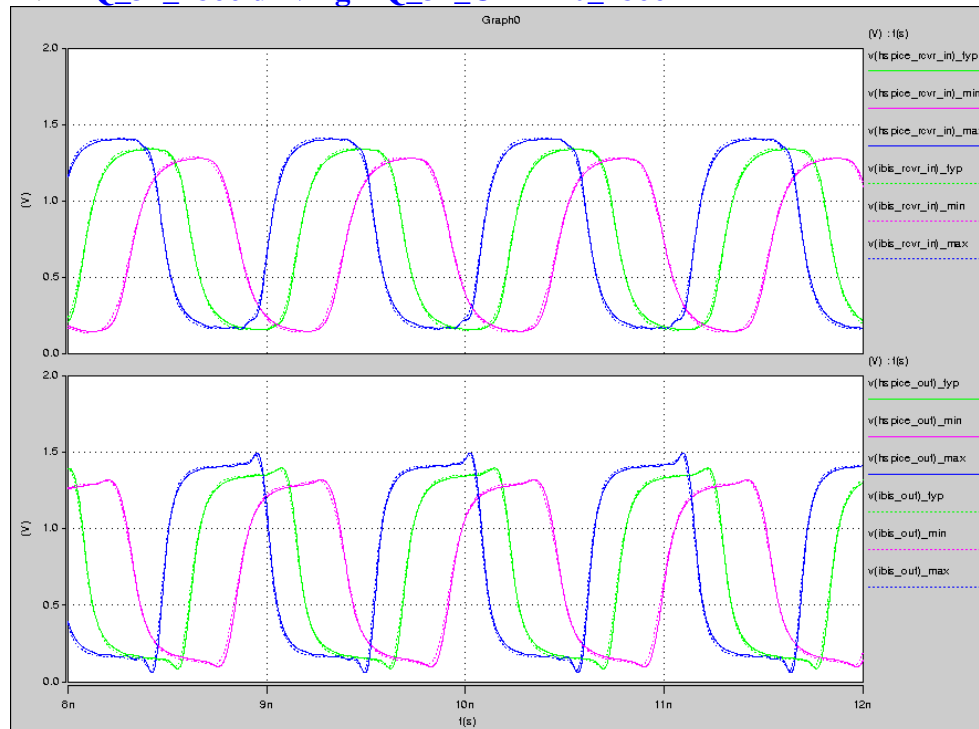
xi. DQ_34_1866 driving DQ_34_ODT40_1866



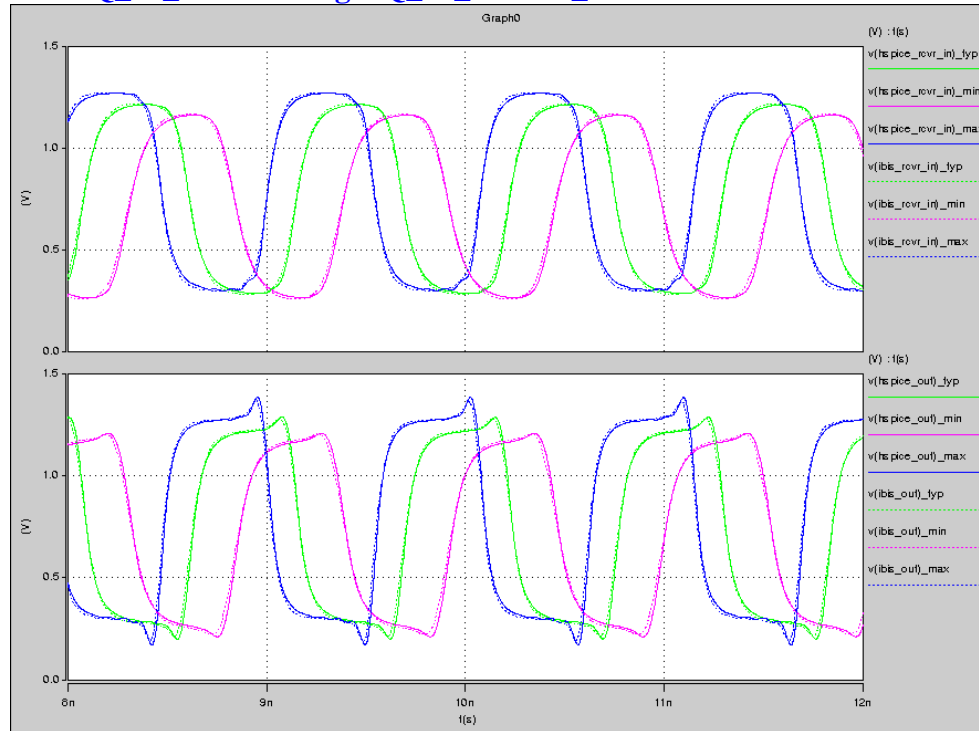
xii. **DQ_34_1866 driving DQ_34_ODT60_1866**



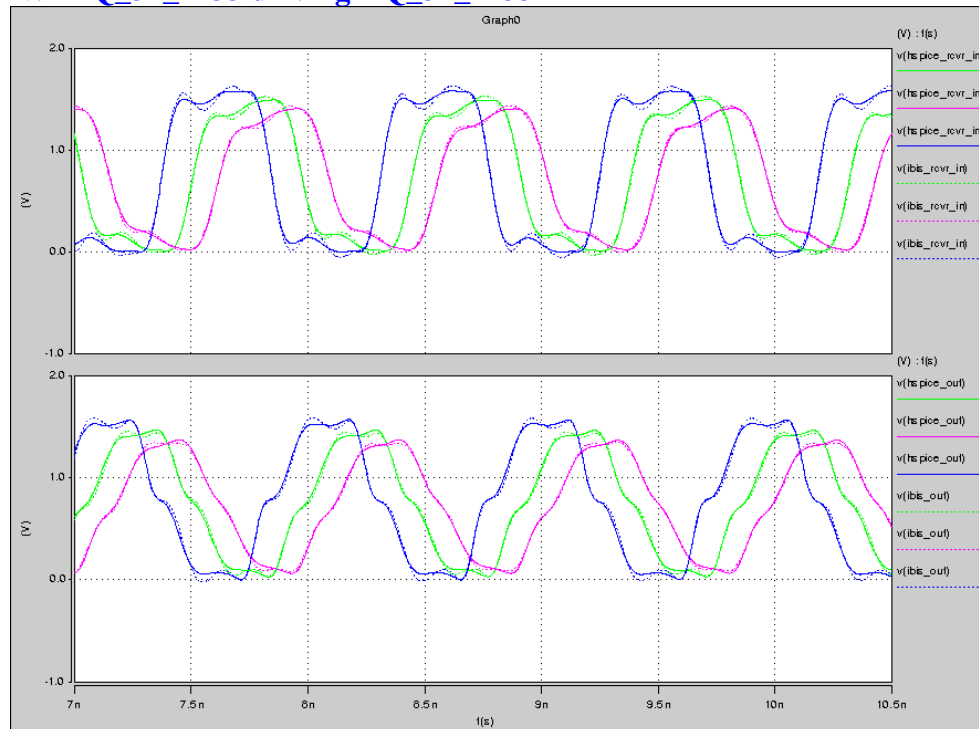
xiii. **DQ_34_1866 driving DQ_34_ODT120_1866**



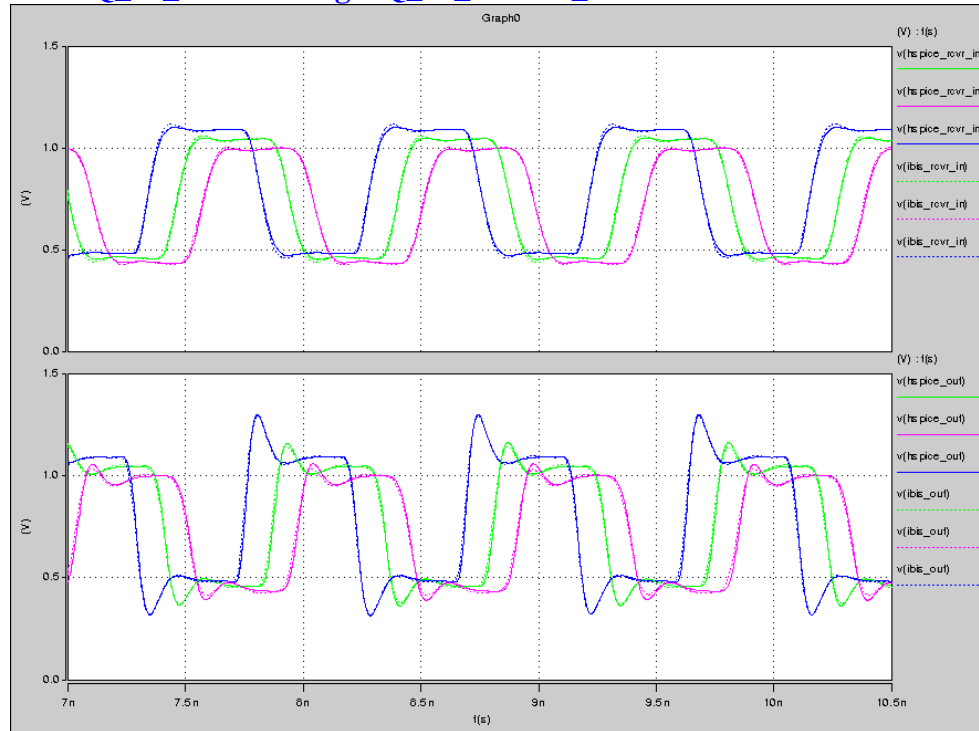
xiv. **DQ_40_1866 driving DQ_40_ODT60_1866**



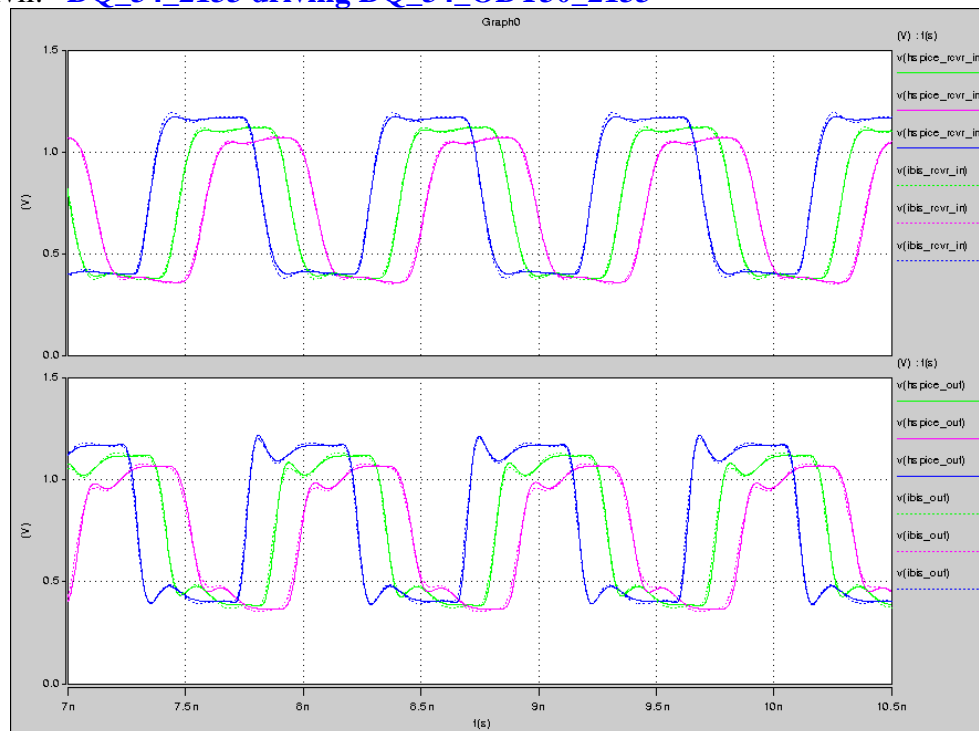
xv. **DQ_34_2133 driving DQ_34_2133**



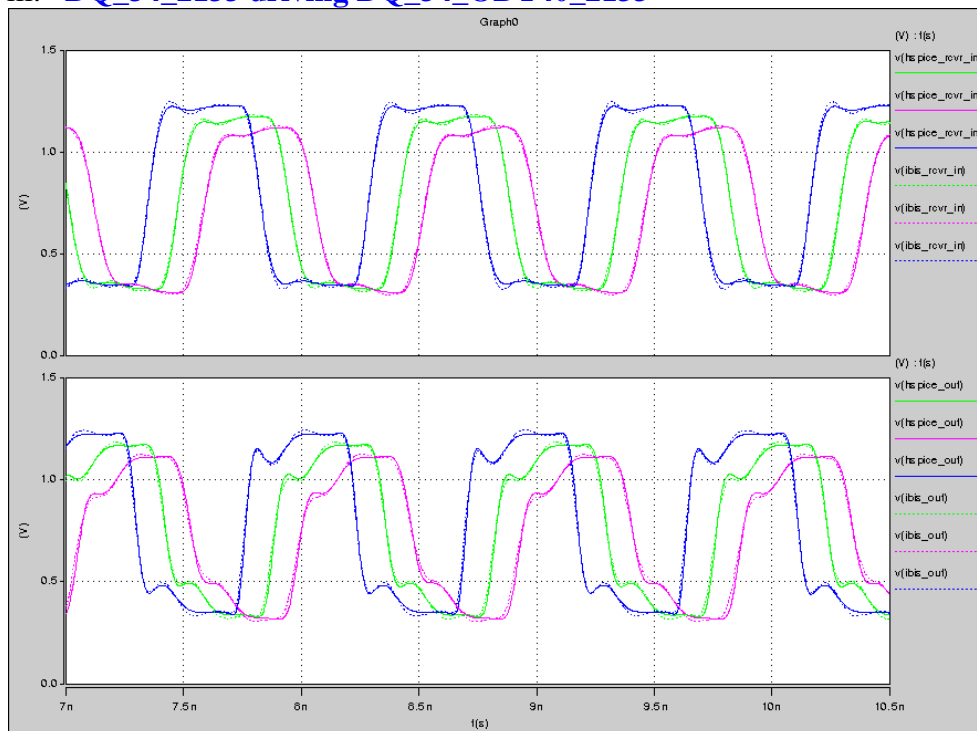
xvi. **DQ_34_2133 driving DQ_34_ODT20_2133**



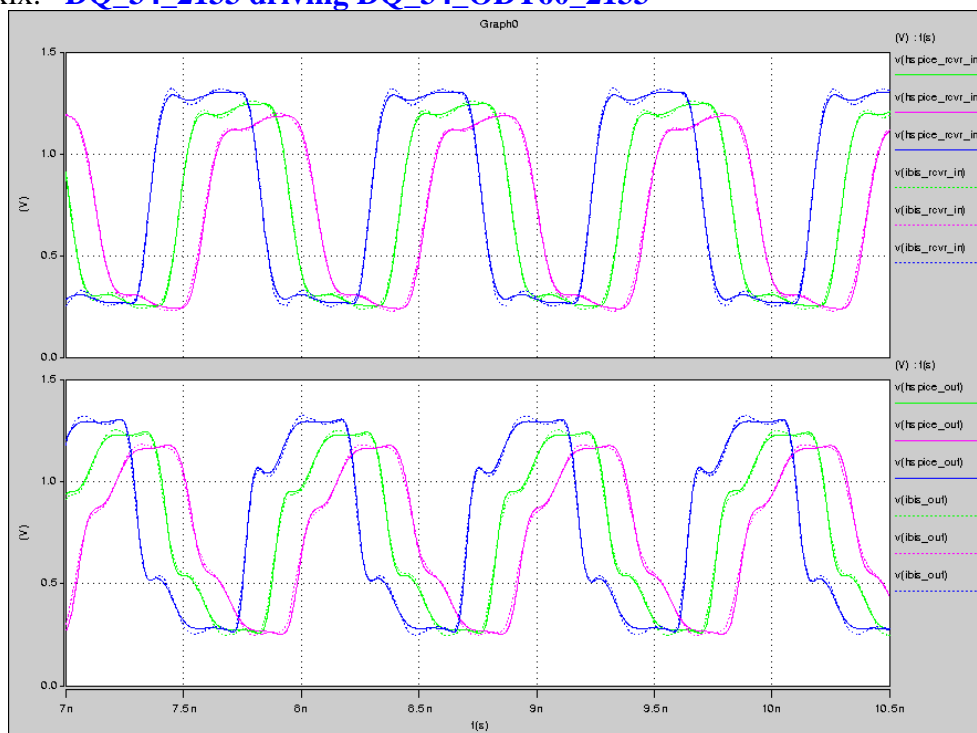
xvii. **DQ_34_2133 driving DQ_34_ODT30_2133**



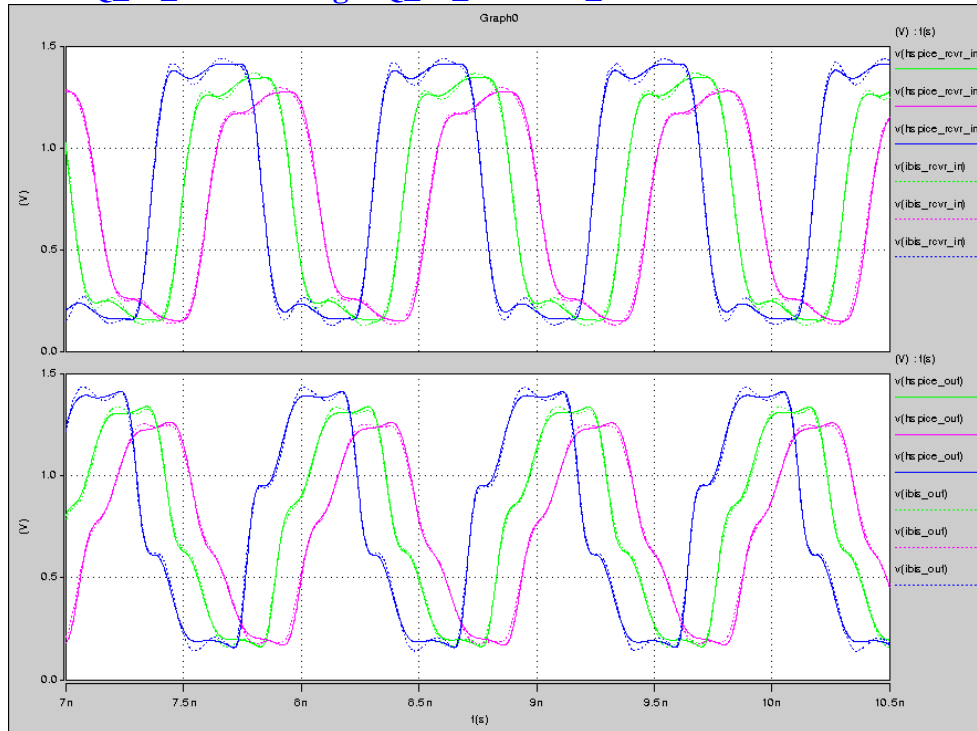
xviii. **DQ_34_2133 driving DQ_34_ODT40_2133**



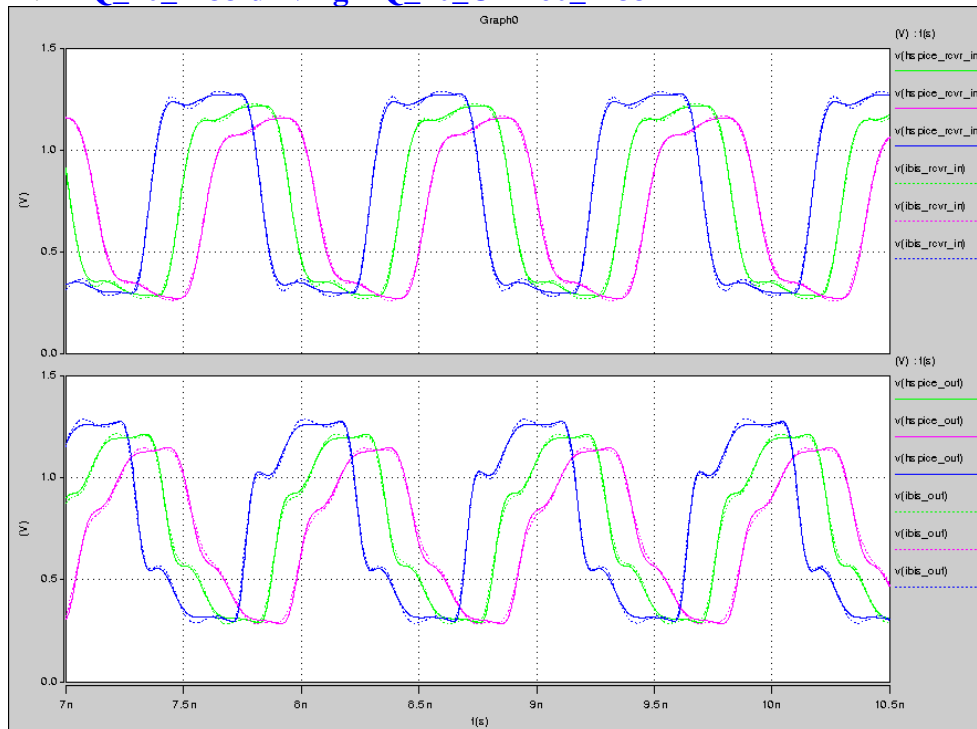
xix. **DQ_34_2133 driving DQ_34_ODT60_2133**



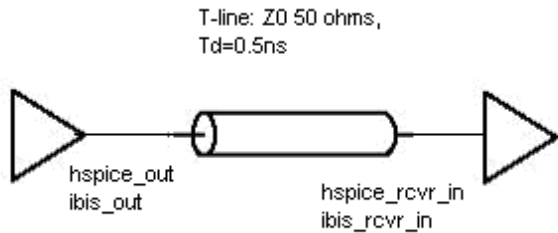
xx. **DQ_34_2133 driving DQ_34_ODT120_2133**



xxi. **DQ_40_2133 driving DQ_40_ODT60_2133**



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.
5. INPUT1_* is applicable to: A3, A4, A5, A6, A7, A8, A9, A13, A14, CKE, CS#, ODT
INPUT2_* is applicable to: A0, A1, A2, A10, A11, A12, BA0, BA1, BA2, CAS#, RAS#, WE#

Document Revision History

- Rev **1.0** - Date **10/15/2012**
- a. IBIS revision **1.0**
 - b. HSpice revision **1.0**
- Rev **2.0** - Date **09/12/2014**
- a. IBIS revision **2.0**
 - b. HSpice revision **2.0**
- Rev **2.1** - Date **08/14/2015**
- a. IBIS revision **2.0**
 - b. HSpice revision **2.0**