IBIS/HSPICE Model Quality Report

Design ID: V90B
Description: 4Gb DDR3 SDRAM
Marketing device name(s): MT41J1G4RG, MT41J512M8RG, MT41J256M16LY, MT41J1G4V90B, MT41J512M8V90B, MT41J256M16V90B
Valid speed grades: DDR3-1066, DDR3-1333, DDR3-1600, DDR3-1866, DDR3-2133 [1]
Zip filename: v90b_ibis.zip
IBIS filename: v90b.ibs **File rev:** 2.0
HSpice filename: v90b_hspice.zip **File rev:** 2.0
EBD filename (if applicable): **File rev:**
Die rev: N
Date: August 15, 2014
Datasheet link: Not Available

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: 90C **Typical:** 45C **Fast:** 0C
VDDQ/VSSQ Decoupling Capacitance: 5.80nF
Included in HSPICE DQ/DQS models? Yes **Amount per DQ/DQS model:** 264pF/526.6pF
VDDQ/VSSQ Decoupling Capacitance Series Resistance: ~0.1ohms

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

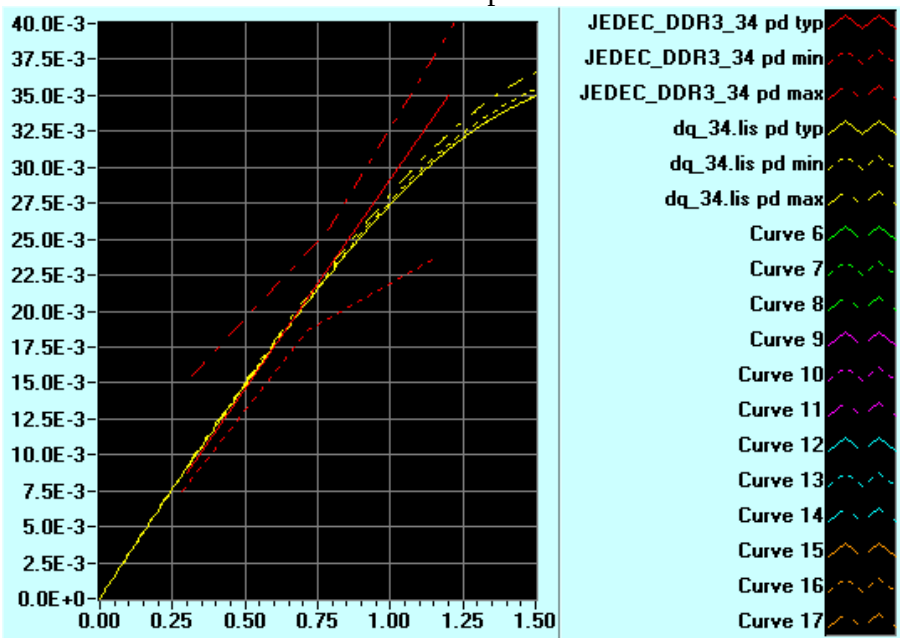
2. ☒ Include the filename of the IBIS Quality Checklist that accompanies this report.

   Filename: v90b_ibis_quality_checklist.xls

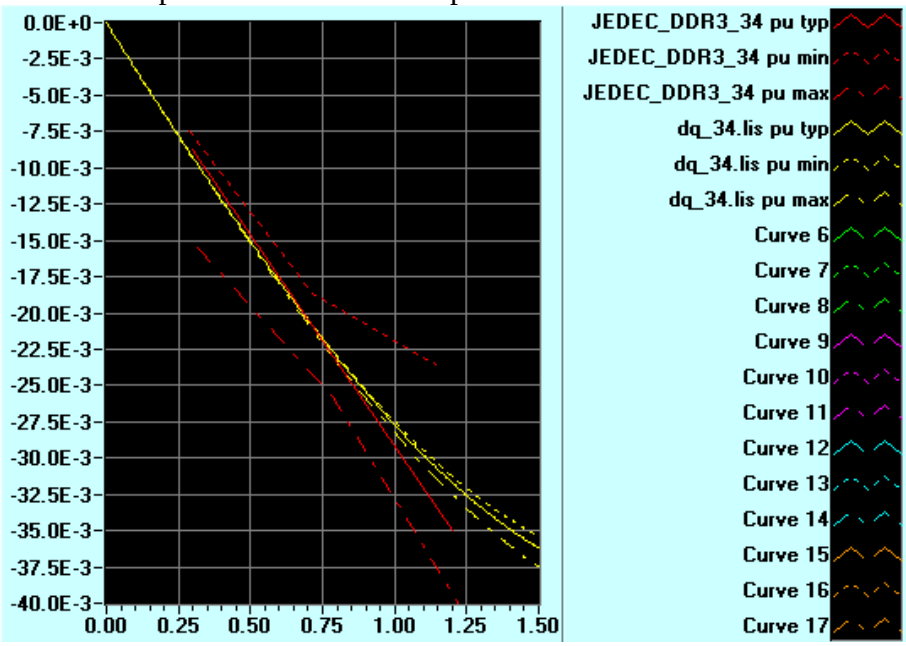
IBIS MODEL Correlation

Datasheet Correlation

1. ☒ For Output or I/O model compare datasheet IOH/IOL data with IBIS pullup/pulldown data.
   a. Model name: **DQ_34**[2]
      i. Pulldown I-V versus **JEDEC** specification

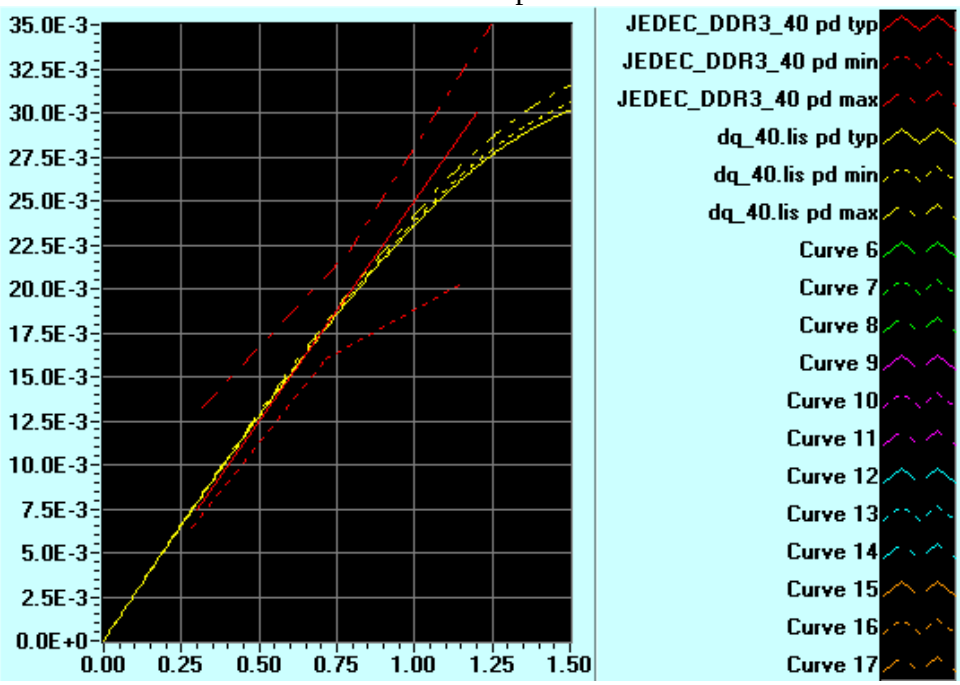


      ii. Pullup I-V versus **JEDEC** specification

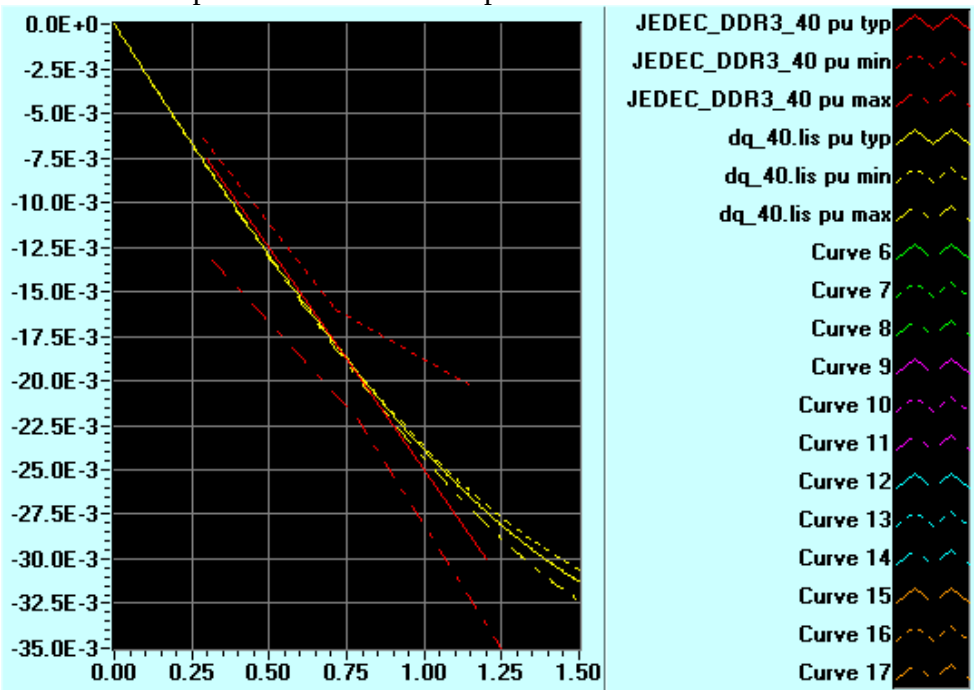


b. Model name: **DQ_40**[2]

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).

Component name: **MT41J512M4RG, MT41J256M8RG (78b, x4/x8)**

		IBIS		Datasheet	
		min	max	min	max
DQ	C_comp	0.90	1.00	NA	NA
	C package	0.47	0.51	NA	NA
	C_total	1.37	1.51	1.50	2.30
DQS	C_comp	1.00	1.10	NA	NA
	C package	0.47	0.48	NA	NA
	C_total	1.47	1.58	1.50	2.30
INPUT	C_comp	0.50	0.60	NA	NA
	C package	0.32	0.40	NA	NA
	C_total	0.82	1.00	0.75	1.30
CLK	C_comp	0.61	0.69	NA	NA
	C package	0.32	0.33	NA	NA
	C_total	0.93	1.02	0.80	1.40

Component name: **MT41J128M16LY (96b, x16)**

		IBIS		Datasheet	
		min	max	min	max
DQ	C_comp	0.90	1.00	NA	NA
	C package	0.47	0.53	NA	NA
	C_total	1.37	1.53	1.50	2.30
DQS	C_comp	1.00	1.10	NA	NA
	C package	0.47	0.49	NA	NA
	C_total	1.47	1.59	1.50	2.30
INPUT	C_comp	0.50	0.60	NA	NA
	C package	0.37	0.46	NA	NA
	C_total	0.87	1.06	0.75	1.30
CLK	C_comp	0.61	0.69	NA	NA
	C package	0.32	0.35	NA	NA
	C_total	0.93	1.04	0.80	1.40

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

		IBIS			Datasheet	
Model	**Slew Rate (V/ns)**	**min**	**typ**	**max**	**min**	**max**
DQ_34	Rising	3.46	3.93	4.98	2.50	6.00
	Falling	3.66	3.98	4.91	2.50	6.00
DQ_40	Rising	3.16	3.75	4.76	2.50	6.00
	Falling	3.48	3.95	4.89	2.50	6.00
DQS_34	Rising	3.45	3.92	4.95	2.50	6.00
	Falling	3.63	3.96	4.90	2.50	6.00
DQS_40	Rising	3.13	3.71	4.71	2.50	6.00
	Falling	3.43	3.90	4.83	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)	-7.82E-03	-7.74E-03	-7.85E-03
Ivih (A)	7.35E-03	7.69E-03	7.60E-03
	TYP	**MAX**	**MIN**
Rtt (Model)	23.06	22.68	22.66
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)	-5.31E-03	-5.26E-03	-5.32E-03
Ivih (A)	4.96E-03	5.18E-03	5.12E-03
	TYP	**MAX**	**MIN**
Rtt (Model)	34.09	33.50	33.52
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)	-4.02E-03	-3.99E-03	-4.03E-03
Ivih (A)	3.74E-03	3.91E-03	3.86E-03
	TYP	**MAX**	**MIN**
Rtt (Model)	45.12	44.32	44.38
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)	-2.71E-03	-2.69E-03	-2.71E-03
Ivih (A)	2.50E-03	2.62E-03	2.59E-03
	TYP	**MAX**	**MIN**
Rtt (Model)	67.17	65.95	66.11
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)	-1.37E-03	-1.36E-03	-1.37E-03
Ivih (A)	1.26E-03	1.32E-03	1.30E-03
	TYP	**MAX**	**MIN**
Rtt (Model)	133.36	130.88	131.30
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.

   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).

Component name: **MT41J512M4RG, MT41J256M8RG (78b, x4/x8)**

		IBIS			Measured		
		min	typ	max	min	typ	max
DQ	C_comp	0.90	0.95	1.00	NA	NA	NA
	C package	0.47	0.48	0.51	NA	NA	NA
	C_total	1.37	1.43	1.51	1.36	1.41	1.51
DQS	C_comp	1.00	1.05	1.10	NA	NA	NA
	C package	0.47	0.47	0.48	NA	NA	NA
	C_total	1.47	1.52	1.58	1.47	1.50	1.53
INPUT	C_comp	0.50	0.55	0.60	NA	NA	NA
	C package	0.32	0.35	0.40	NA	NA	NA
	C_total	0.82	0.90	1.00	0.83	0.97	1.22
CLK	C_comp	0.61	0.65	0.69	NA	NA	NA
	C package	0.32	0.33	0.33	NA	NA	NA
	C_total	0.93	0.98	1.02	0.95	0.97	0.99

Component name: **MT41J128M16LY (96b, x16)**

		IBIS			Measured		
		min	typ	max	min	typ	max
DQ	C_comp	0.90	0.95	1.00	NA	NA	NA
	C package	0.47	0.50	0.53	NA	NA	NA
	C_total	1.37	1.45	1.53	1.38	1.45	1.53
DQS	C_comp	1.00	1.05	1.10	NA	NA	NA
	C package	0.47	0.48	0.49	NA	NA	NA
	C_total	1.47	1.53	1.59	1.49	1.53	1.57
INPUT	C_comp	0.50	0.55	0.60	NA	NA	NA
	C package	0.37	0.41	0.46	NA	NA	NA
	C_total	0.87	0.96	1.06	0.89	0.97	1.06
CLK	C_comp	0.61	0.65	0.69	NA	NA	NA
	C package	0.32	0.33	0.35	NA	NA	NA
	C_total	0.93	0.98	1.04	0.96	0.99	1.02

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

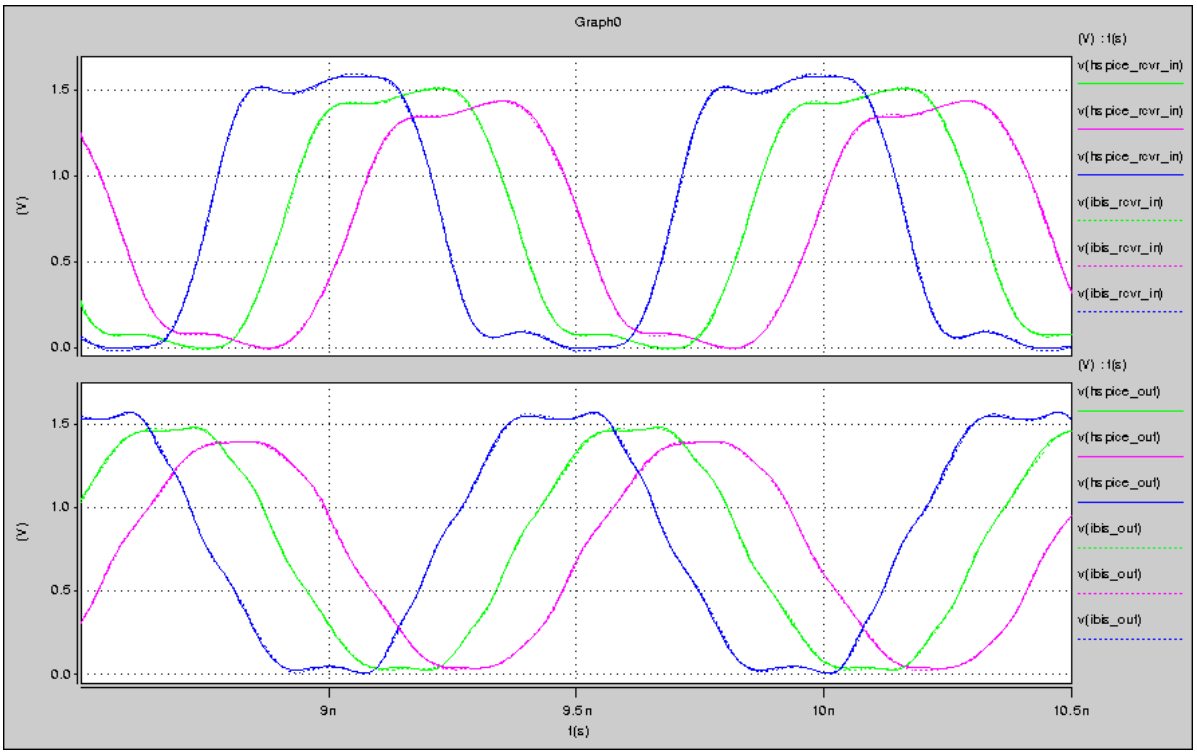
4. ☐ If slew rate data (rise/fall slew) is available from measurements, complete Spice simulations to generate slew rate data and provide a comparison table.

   Not Available

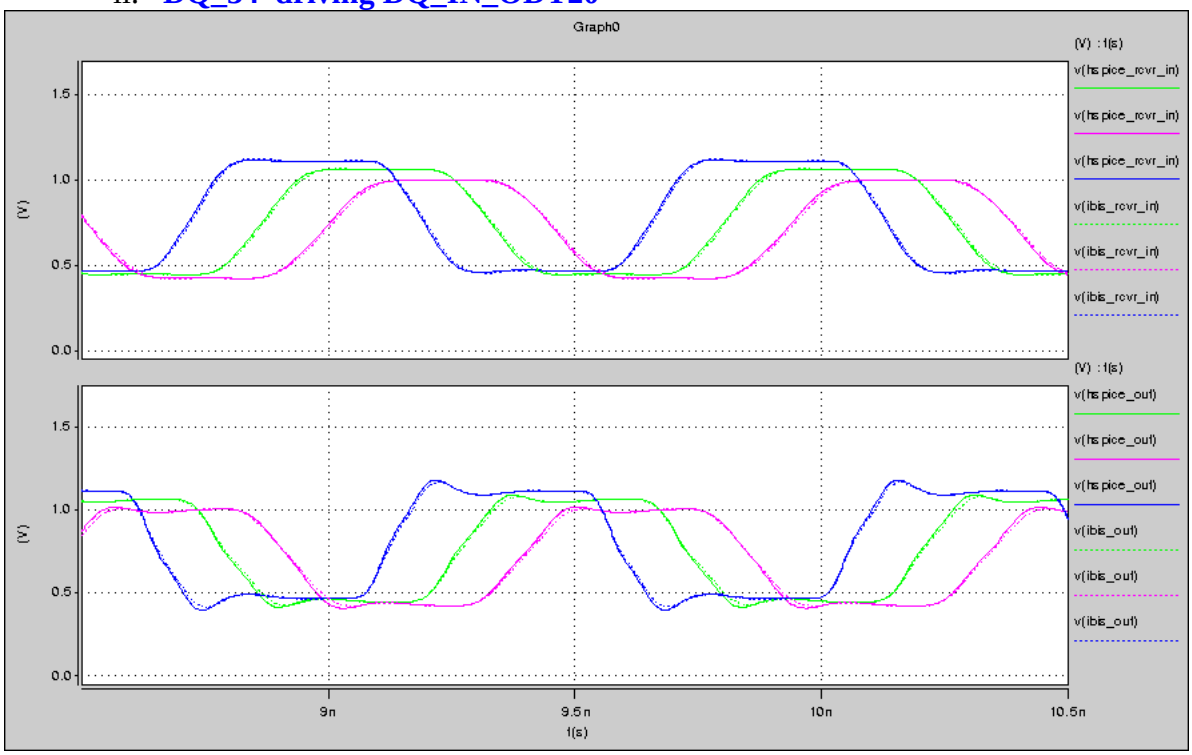
IBIS vs Spice Correlation

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: **HSPICE 2013.12-SP1**
   b. ☒ Run simulations for all corners cases and at fastest speed grades, testing ODT models as loads when applicable.

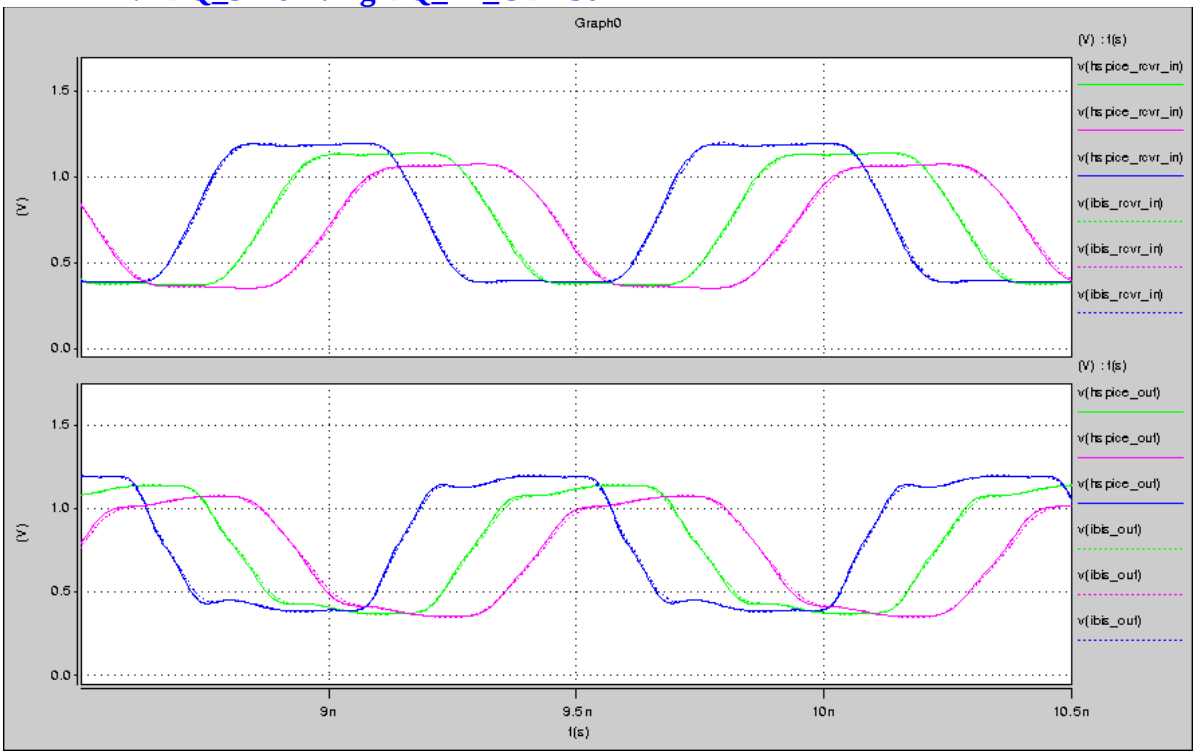
      i. **DQ_34 driving DQ_34**



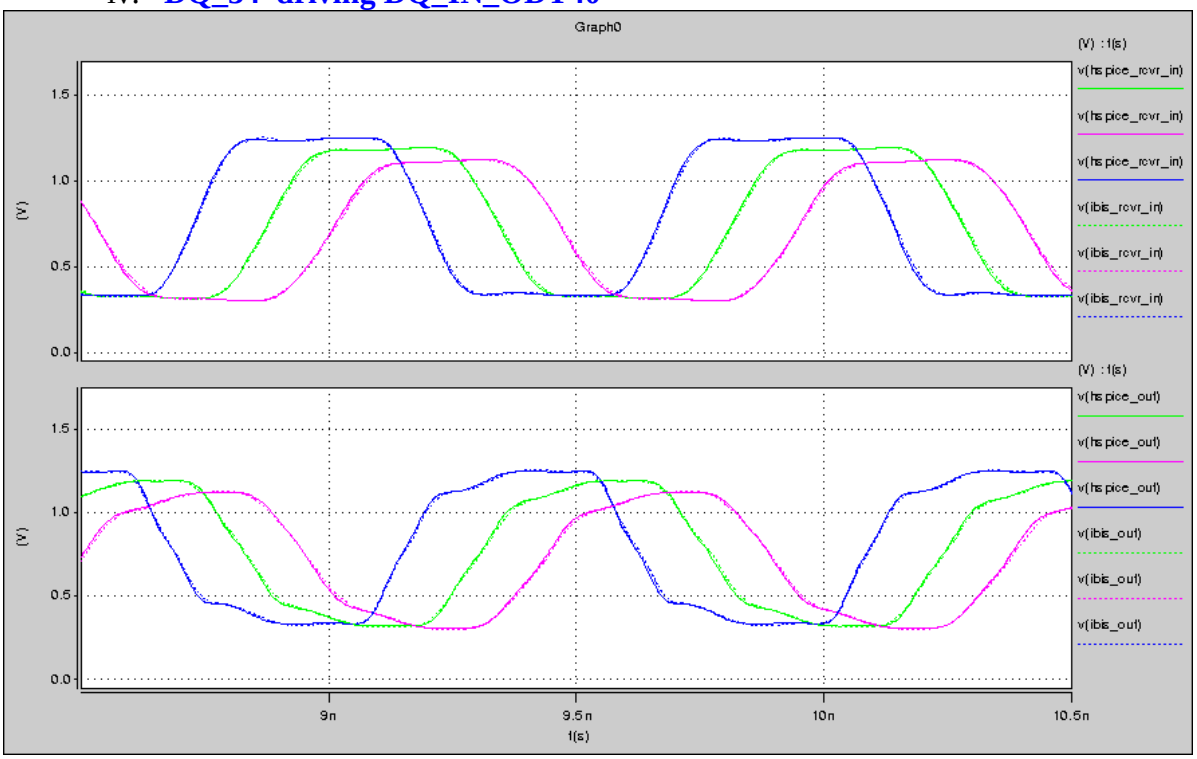
ii. **DQ_34 driving DQ_IN_ODT20**



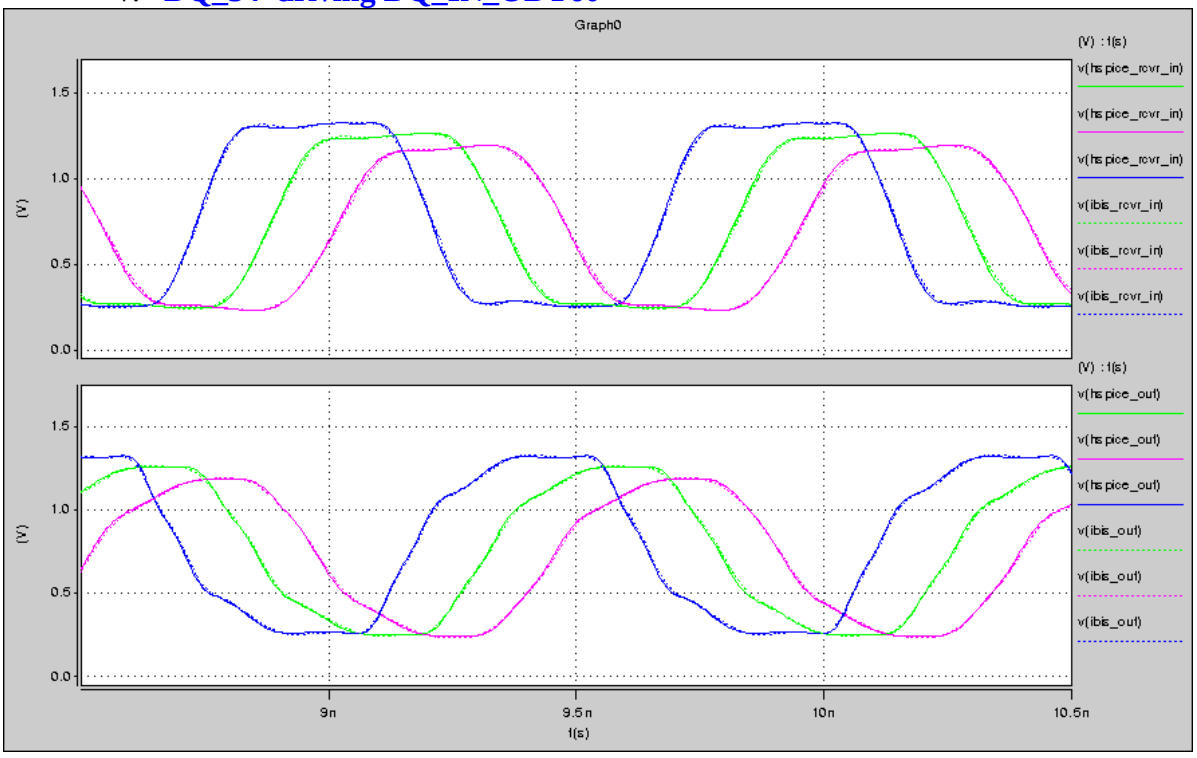
iii. **DQ_34 driving DQ_IN_ODT30**



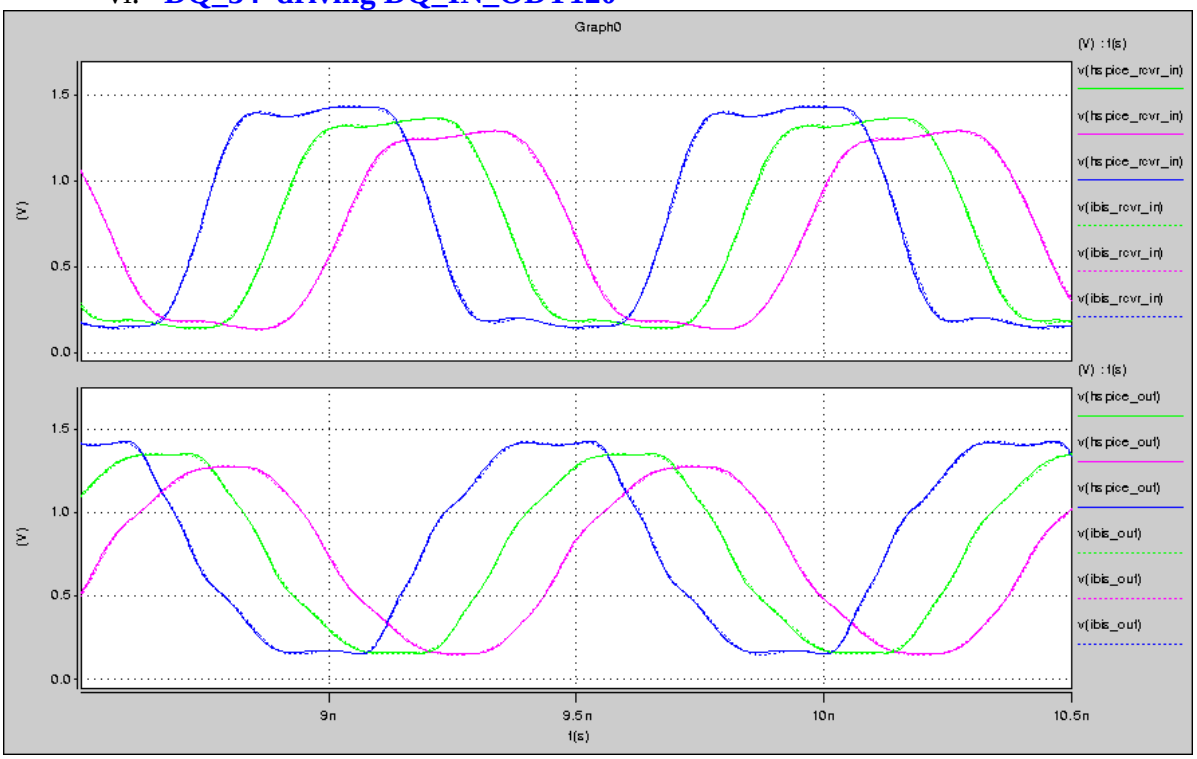
iv. **DQ_34 driving DQ_IN_ODT40**



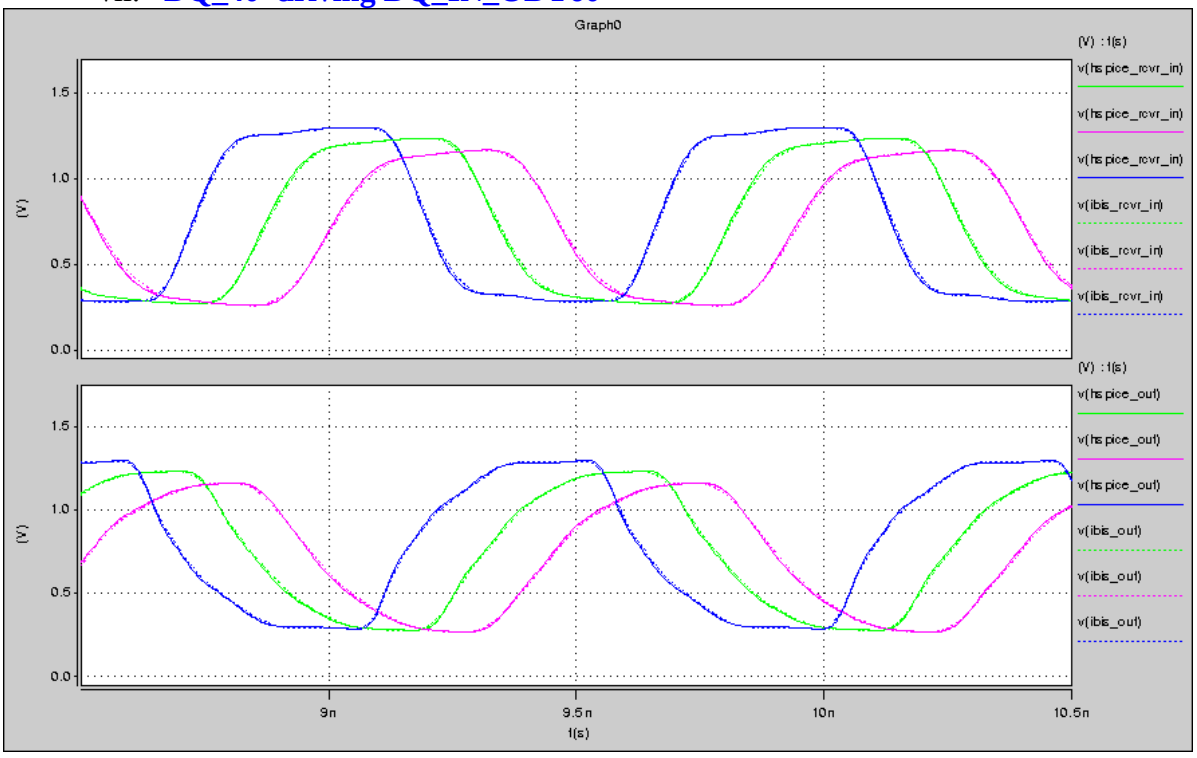
v. **DQ_34 driving DQ_IN_ODT60**



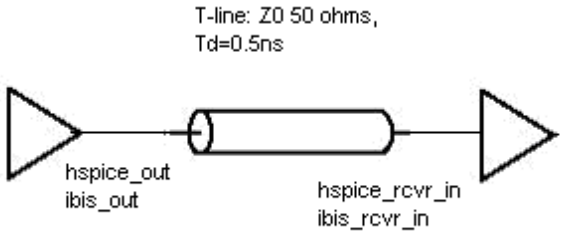
vi. **DQ_34 driving DQ_IN_ODT120**



vii. **DQ_40 driving DQ_IN_ODT60**



Setup



Comments:

1. IBIS model may not reflect speed grade availability.
2. Simulated I-V curves are the same for all speed grades.
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.

Document Revision History

Rev **1.0** - Date **05/22/2013**
- a. IBIS revision **1.0**
- b. HSpice revision **1.0**

Rev **2.0** - Date **08/15/2014**
- a. IBIS revision **2.0**
- b. HSpice revision **2.0**