
IBIS/HSPICE Model Quality Report

Design ID: **F66A**

Description: **288Mb x9, x18 and x36 RDRAM**

Marketing device name(s): **MT49H32M9FM, MT49H16M18FM, MT49H8M36FM, MT49H16M18CFM
MT49H32M9SJ, MT49H16M18SJ, MT49H8M36SJ, MT49H16M18CSJ**

Valid speed grades: **RL2-600/800/1067**

Zip filename: **f66a_ibis.zip, f66a_hspice.zip**

IBIS filename: **f66a_18vccq.ibs, f66a_18vccq_it.ibs, f66a_15vccq.ibs, f66a_15vccq_it.ibs** File rev: **2.5**

HSpice filename: **f66a_hspice.zip** File rev: **2.1**

EBD filename (if applicable): File rev:

Die rev: **B**

Date: **August 12, 2015**

Datasheet Link (from micron.com): http://www.micron.com/~media/documents/products/data-sheet/dram/288mb_rldram_2_cio.pdf, http://www.micron.com/~media/documents/products/data-sheet/dram/288mb_rldram_2_sio.pdf

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

Device Parameters

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

VDDQ 1.5v – Slow: **1.4** Typical: **1.5** Fast: **1.6**

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

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

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

VDDQ/VSSQ Decoupling Capacitance: **6.00nF (36DQ+4QOUT)**

Included in HSPICE DQ/DQS models? **YES** Amount per DQ model: **150pF**

VDDQ/VSSQ Decoupling Capacitance Series Resistance: **5.25 Ohms/DQ**

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: **3MSX**

Exceptions: **Overshoot parameters not available**

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

Filename: f66a_ibis_quality_checklist.xlsx

IBIS MODEL Correlation

Datasheet Correlation

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

1.8V Pullup/Pulldown Impedance(Measured at 0.5*vccq)

Model	Drive	VCCQ	Corner	Simulation		Spec	
				Rpd	Rpu	Rpd	Rpu
DQ_18V_25OHMS_800	25	1.8	TT	24.93	24.99	25	25
		1.7	SS	25.04	25.18	28.75	28.75
		1.9	FF	25.48	25.29	21.25	21.25
DQ_18V_30OHMS_800	30	1.8	TT	29.79	30.37	30	30
		1.7	SS	29.83	30.36	34.5	34.5
		1.9	FF	30.38	30.62	25.5	25.5
DQ_18V_35OHMS_800	35	1.8	TT	35.04	35.54	35	35
		1.7	SS	34.53	34.80	40.25	40.25
		1.9	FF	35.88	34.63	29.75	29.75
DQ_18V_40OHMS_800	40	1.8	TT	41.40	40.79	40	40
		1.7	SS	39.55	40.61	46	46
		1.9	FF	40.76	40.87	34	34
DQ_18V_45OHMS_800	45	1.8	TT	44.53	44.31	45	45
		1.7	SS	45.13	44.79	51.75	51.75
		1.9	FF	44.72	44.80	38.25	38.25
DQ_18V_50OHMS_800	50	1.8	TT	50.83	50.24	50	50
		1.7	SS	50.49	49.27	57.5	57.5
		1.9	FF	49.53	51.38	42.5	42.5
DQ_18V_55OHMS_800	55	1.8	TT	54.94	54.64	55	55
		1.7	SS	55.46	54.45	63.25	63.25
		1.9	FF	55.45	53.80	46.75	46.75
DQ_18V_60OHMS_800	60	1.8	TT	61.16	60.69	60	60
		1.7	SS	59.42	59.76	69	69
		1.9	FF	58.46	61.15	51	51
DQ_18V_25OHMS_1066	25	1.8	TT	24.93	25.14	25	25
		1.7	SS	24.96	25.31	28.75	28.75
		1.9	FF	25.48	24.96	21.25	21.25
DQ_18V_30OHMS_1066	30	1.8	TT	29.79	30.07	30	30
		1.7	SS	29.84	30.55	34.5	34.5
		1.9	FF	30.38	30.11	25.5	25.5
DQ_18V_35OHMS_1066	35	1.8	TT	35.04	35.12	35	35
		1.7	SS	35.34	35.70	40.25	40.25
		1.9	FF	35.88	34.75	29.75	29.75
DQ_18V_40OHMS_1066	40	1.8	TT	41.40	41.29	40	40
		1.7	SS	39.94	40.74	46	46
		1.9	FF	40.76	40.08	34	34
DQ_18V_45OHMS_1066	45	1.8	TT	44.53	45.81	45	45
		1.7	SS	44.91	46.06	51.75	51.75
		1.9	FF	44.72	45.91	38.25	38.25
DQ_18V_50OHMS_1066	50	1.8	TT	50.83	50.54	50	50
		1.7	SS	49.55	50.52	57.5	57.5
		1.9	FF	49.53	50.09	42.5	42.5
DQ_18V_55OHMS_1066	55	1.8	TT	54.94	55.63	55	55
		1.7	SS	55.87	55.86	63.25	63.25
		1.9	FF	55.45	55.22	46.75	46.75
DQ_18V_60OHMS_1066	60	1.8	TT	61.16	60.61	60	60
		1.7	SS	60.56	61.06	69	69
		1.9	FF	58.46	59.60	51	51

1.5V Pullup/Pulldown Impedance(Measured at 0.5*vccq)

Model	Drive	VCCQ	Corner	Simulation		Spec	
				Rpd	Rpu	Rpd	Rpu
DQ_15V_250HMS_800	25	1.5	TT	25.35	25.14	25	25
		1.4	SS	25.15	25.43	28.75	28.75
		1.6	FF	25.14	24.96	21.25	21.25
DQ_15V_300HMS_800	30	1.5	TT	29.76	30.07	30	30
		1.4	SS	30.53	30.63	34.5	34.5
		1.6	FF	29.99	30.11	25.5	25.5
DQ_15V_350HMS_800	35	1.5	TT	35.20	35.12	35	35
		1.4	SS	35.63	35.36	40.25	40.25
		1.6	FF	34.99	34.75	29.75	29.75
DQ_15V_400HMS_800	40	1.5	TT	39.91	41.29	40	40
		1.4	SS	40.51	41.04	46	46
		1.6	FF	39.06	40.08	34	34
DQ_15V_450HMS_800	45	1.5	TT	44.87	45.81	45	45
		1.4	SS	45.68	46.17	51.75	51.75
		1.6	FF	44.66	45.91	38.25	38.25
DQ_15V_500HMS_800	50	1.5	TT	49.51	50.54	50	50
		1.4	SS	50.23	50.24	57.5	57.5
		1.6	FF	50.99	50.09	42.5	42.5
DQ_15V_550HMS_800	55	1.5	TT	55.82	55.63	55	55
		1.4	SS	55.60	56.24	63.25	63.25
		1.6	FF	56.55	55.22	46.75	46.75
DQ_15V_600HMS_800	60	1.5	TT	60.87	60.61	60	60
		1.4	SS	60.38	60.04	69	69
		1.6	FF	59.33	59.60	51	51
DQ_15V_250HMS_1066	25	1.5	TT	25.35	25.14	25	25
		1.4	SS	25.48	25.31	28.75	28.75
		1.6	FF	25.14	24.96	21.25	21.25
DQ_15V_300HMS_1066	30	1.5	TT	29.76	30.07	30	30
		1.4	SS	30.60	30.55	34.5	34.5
		1.6	FF	29.99	30.11	25.5	25.5
DQ_15V_350HMS_1066	35	1.5	TT	35.20	35.12	35	35
		1.4	SS	35.33	35.70	40.25	40.25
		1.6	FF	34.99	34.75	29.75	29.75
DQ_15V_400HMS_1066	40	1.5	TT	39.91	41.29	40	40
		1.4	SS	41.15	40.74	46	46
		1.6	FF	39.06	40.08	34	34
DQ_15V_450HMS_1066	45	1.5	TT	44.87	45.81	45	45
		1.4	SS	45.72	46.06	51.75	51.75
		1.6	FF	44.66	45.91	38.25	38.25
DQ_15V_500HMS_1066	50	1.5	TT	49.51	50.54	50	50
		1.4	SS	50.70	50.52	57.5	57.5
		1.6	FF	50.99	50.09	42.5	42.5
DQ_15V_550HMS_1066	55	1.5	TT	55.82	55.63	55	55
		1.4	SS	55.21	55.86	63.25	63.25
		1.6	FF	56.55	55.22	46.75	46.75
DQ_15V_600HMS_1066	60	1.5	TT	60.87	60.61	60	60
		1.4	SS	60.86	61.06	69	69
		1.6	FF	59.33	59.60	51	51

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: **MT49H8M36FM**

		IBIS		Datasheet	
		min	max	min	max
DQ/Q_OUT	C_comp	2.78	3.03	NA	NA
	C_package	0.26	0.42	NA	NA
	C_total	3.04	3.45	3.0	4.5
INPUT	C_comp	0.92	1.18	NA	NA
	C_package	0.21	0.40	NA	NA
	C_total	1.13	1.58	1.0	2.0
CLK/DK	C_comp	1.28	1.53	NA	NA
	C_package	0.26	0.27	NA	NA
	C_total	1.54	1.80	1.5	2.5
TDO	C_comp	2.80	3.00	NA	NA
	C_package	0.52	0.52	NA	NA
	C_total	3.32	3.52	1.5	4.5
TDI	C_comp	1.08	1.35	NA	NA
	C_package	0.55	0.55	NA	NA
	C_total	1.63	1.90	1.5	4.5
TMS	C_comp	1.48	1.75	NA	NA
	C_package	0.66	0.66	NA	NA
	C_total	2.14	2.41	1.5	4.5
TCK	C_comp	1.08	1.33	NA	NA
	C_package	0.68	0.68	NA	NA
	C_total	1.76	2.01	1.5	4.5

Component name: **MT49H8M36SJ**

		IBIS		Datasheet	
		min	max	min	max
DQ/Q_OUT	C_comp	2.78	3.03	NA	NA
	C_package	1.06	1.26	NA	NA
	C_total	3.84	4.29	3.5	5.0
INPUT	C_comp	0.92	1.18	NA	NA
	C_package	0.87	1.18	NA	NA
	C_total	1.79	2.36	1.5	2.5
CLK/DK	C_comp	1.28	1.53	NA	NA
	C_package	0.95	1.06	NA	NA
	C_total	2.23	2.59	2.0	3.0
TDO	C_comp	2.80	3.00	NA	NA
	C_package	1.78	1.78	NA	NA
	C_total	4.58	4.78	2.0	5.0
TDI	C_comp	1.08	1.35	NA	NA
	C_package	1.94	1.94	NA	NA
	C_total	3.02	3.29	2.0	5.0
TMS	C_comp	1.48	1.75	NA	NA
	C_package	1.97	1.97	NA	NA
	C_total	3.45	3.72	2.0	5.0
TCK	C_comp	1.08	1.33	NA	NA
	C_package	1.99	1.99	NA	NA
	C_total	3.07	3.32	2.0	5.0

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.

NOT AVAILABLE

4. ☒ Compare ODT data with datasheet.

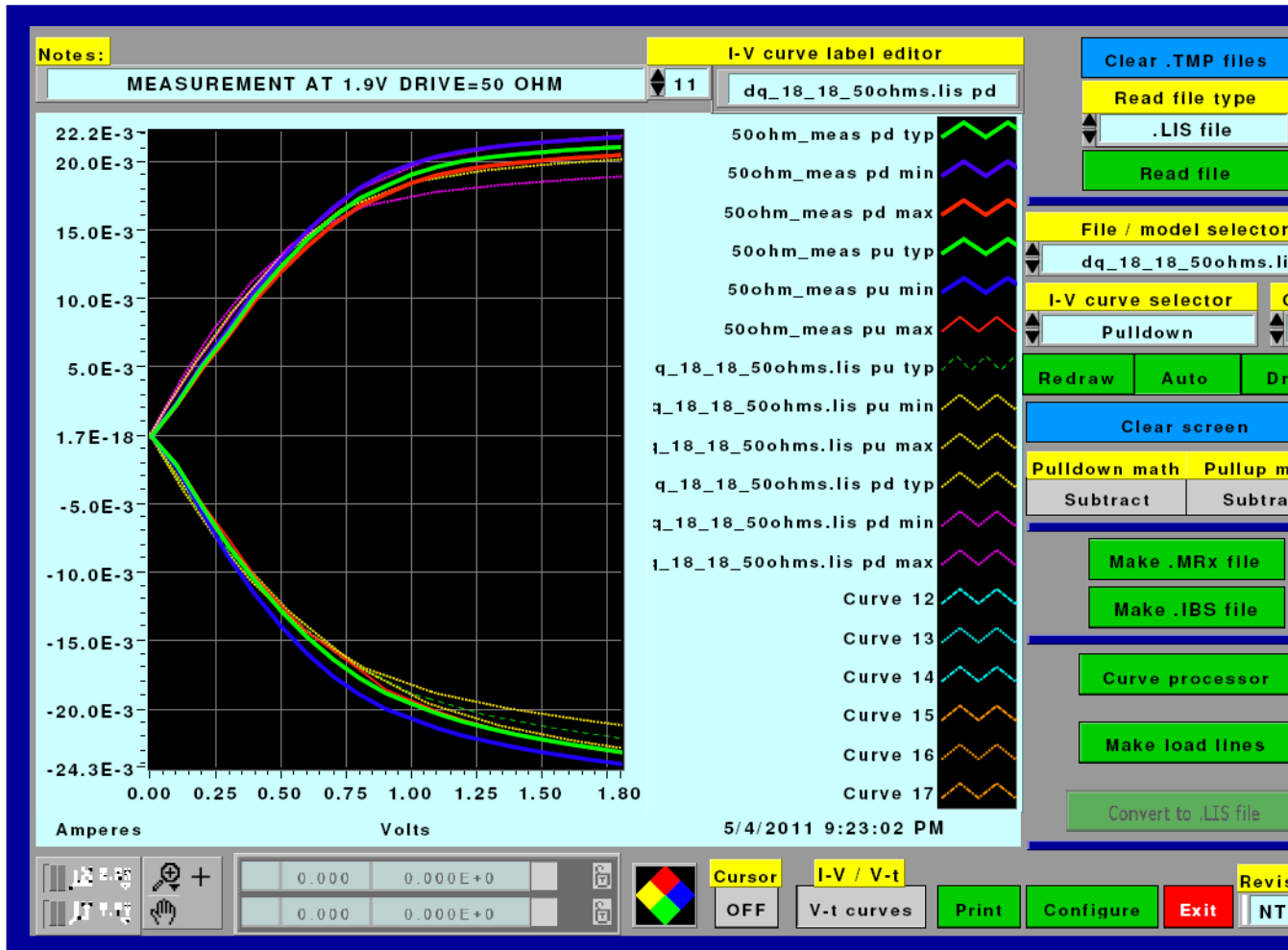
ODT calculated using the formula $RTT = (VOH - VTT) / I$ where $VOH = VTT + 0.4V$

		Model			Spec	
	VCCQ	TYP	SLOW	FAST	Min	Max
ODT_800	1.8	148	164	137	125	185
	1.5	147	162	136	125	185

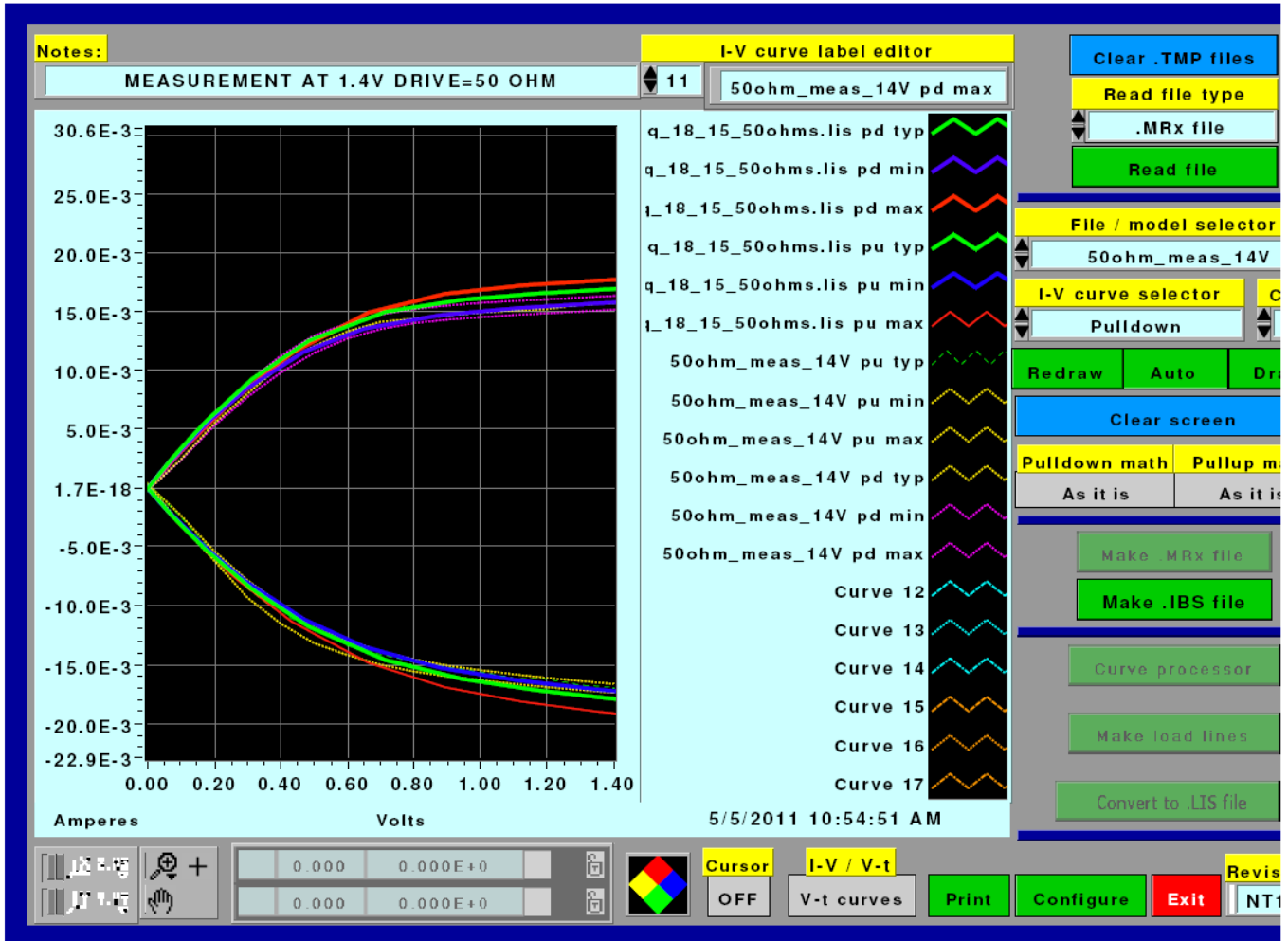
Measurement Correlation

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.

DQ 18V 50OHMS 800

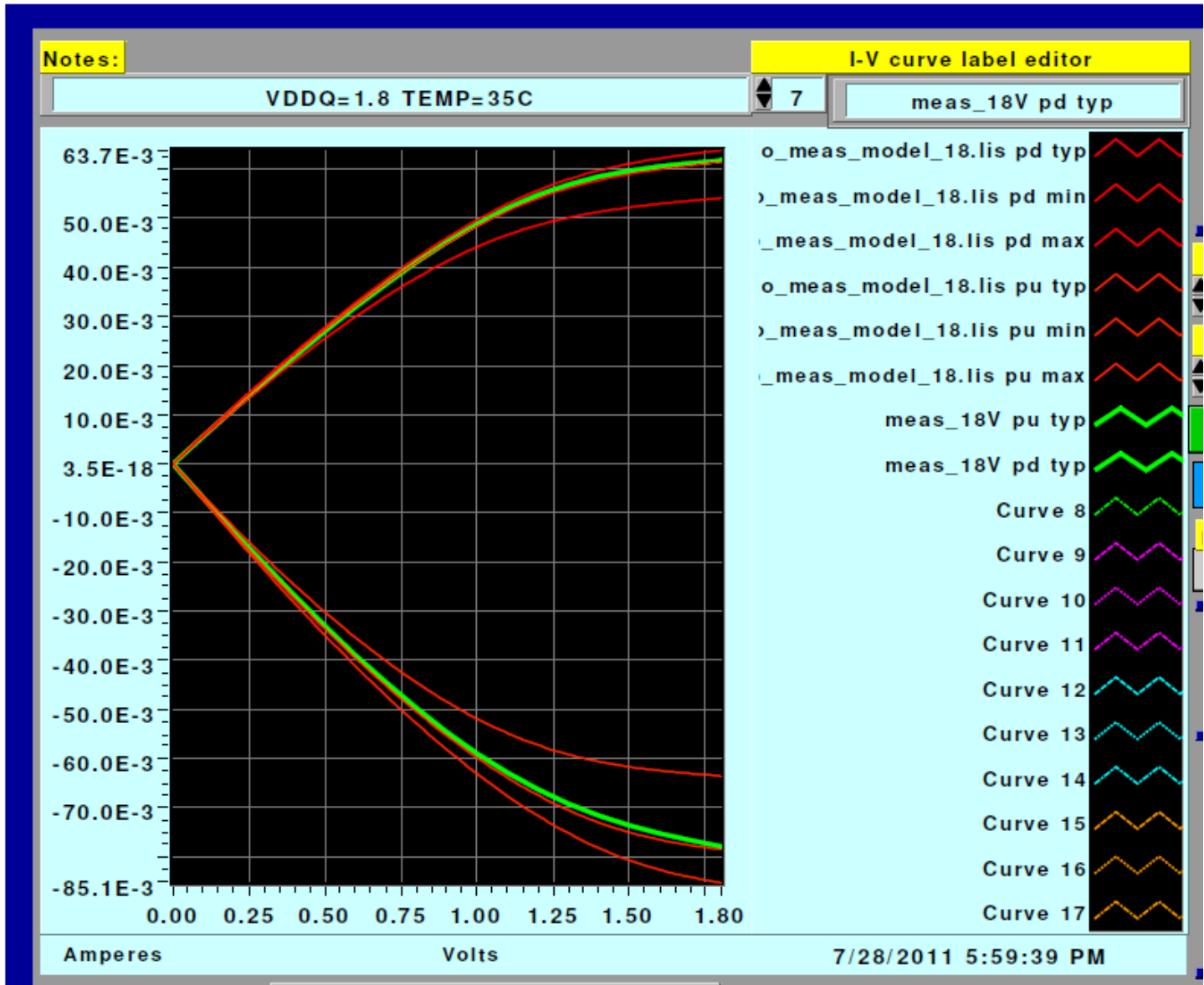


DQ 15V 50OHMS 800



TDO OUT 18V 800

(see comment section)



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: **MT49H8M36FM**

		IBIS			Measured		
		min	typ	max	min	typ	max
DQ/Q_OUT	C_comp	2.78	2.90	3.03	NA	NA	NA
	C package	0.26	0.34	0.42	NA	NA	NA
	C_total	3.04	3.24	3.45	3.06	3.19	3.36
INPUT	C_comp	0.92	1.05	1.18	NA	NA	NA
	C package	0.21	0.28	0.40	NA	NA	NA
	C_total	1.13	1.33	1.58	1.20	1.31	1.50
CLK/DK	C_comp	1.28	1.40	1.53	NA	NA	NA
	C package	0.26	0.27	0.27	NA	NA	NA
	C_total	1.54	1.67	1.80	1.58	1.62	1.66
TDO	C_comp	2.80	2.90	3.00	NA	NA	NA
	C package	0.52	0.52	0.52	NA	NA	NA
	C_total	3.32	3.42	3.52	3.36	3.41	3.46
TDI	C_comp	1.08	1.20	1.35	NA	NA	NA
	C package	0.55	0.55	0.55	NA	NA	NA
	C_total	1.63	1.75	1.90	1.83	1.86	1.89
TMS	C_comp	1.48	1.60	1.75	NA	NA	NA
	C package	0.66	0.66	0.66	NA	NA	NA
	C_total	2.14	2.26	2.41	2.21	2.24	2.27
TCK	C_comp	1.08	1.20	1.33	NA	NA	NA
	C package	0.68	0.68	0.68	NA	NA	NA
	C_total	1.76	1.88	2.01	1.82	1.86	1.90

Component name: **MT49H8M36SJ**

		IBIS			Measured		
		min	typ	max	min	typ	max
DQ/Q_OUT	C_comp	2.78	2.90	3.03	NA	NA	NA
	C_package	1.06	1.20	1.26	NA	NA	NA
	C_total	3.84	4.10	4.29	3.21	3.29	3.56
INPUT	C_comp	0.92	1.05	1.18	NA	NA	NA
	C_package	0.87	1.11	1.18	NA	NA	NA
	C_total	1.79	2.16	2.36	1.86	2.21	2.38
CLK/DK	C_comp	1.28	1.40	1.53	NA	NA	NA
	C_package	0.95	1.00	1.06	NA	NA	NA
	C_total	2.23	2.40	2.59	2.22	2.37	2.55
TDO	C_comp	2.80	2.90	3.00	NA	NA	NA
	C_package	1.78	1.78	1.78	NA	NA	NA
	C_total	4.58	4.68	4.78	4.49	4.61	4.74
TDI	C_comp	1.08	1.20	1.35	NA	NA	NA
	C_package	1.94	1.94	1.94	NA	NA	NA
	C_total	3.02	3.14	3.29	3.04	3.17	3.30
TMS	C_comp	1.48	1.60	1.75	NA	NA	NA
	C_package	1.97	1.97	1.97	NA	NA	NA
	C_total	3.45	3.57	3.72	3.41	3.55	3.68
TCK	C_comp	1.08	1.20	1.33	NA	NA	NA
	C_package	1.99	1.99	1.99	NA	NA	NA
	C_total	3.07	3.19	3.32	3.09	3.21	3.34

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 HSpice simulations to generate slew rate data and provide a comparison table.

	Model						Meas			
	Rise(V/ns)			Fall(V/ns)			Rise(V/ns)		Fall(V/ns)	
	TYP	SLOW	FAST	TYP	SLOW	FAST	SLOW	FAST	SLOW	FAST
DQ_18V_50OHMS_800	5.45	4.43	6.09	5.25	4.24	6.14	5.11	6.98	4.50	6.67

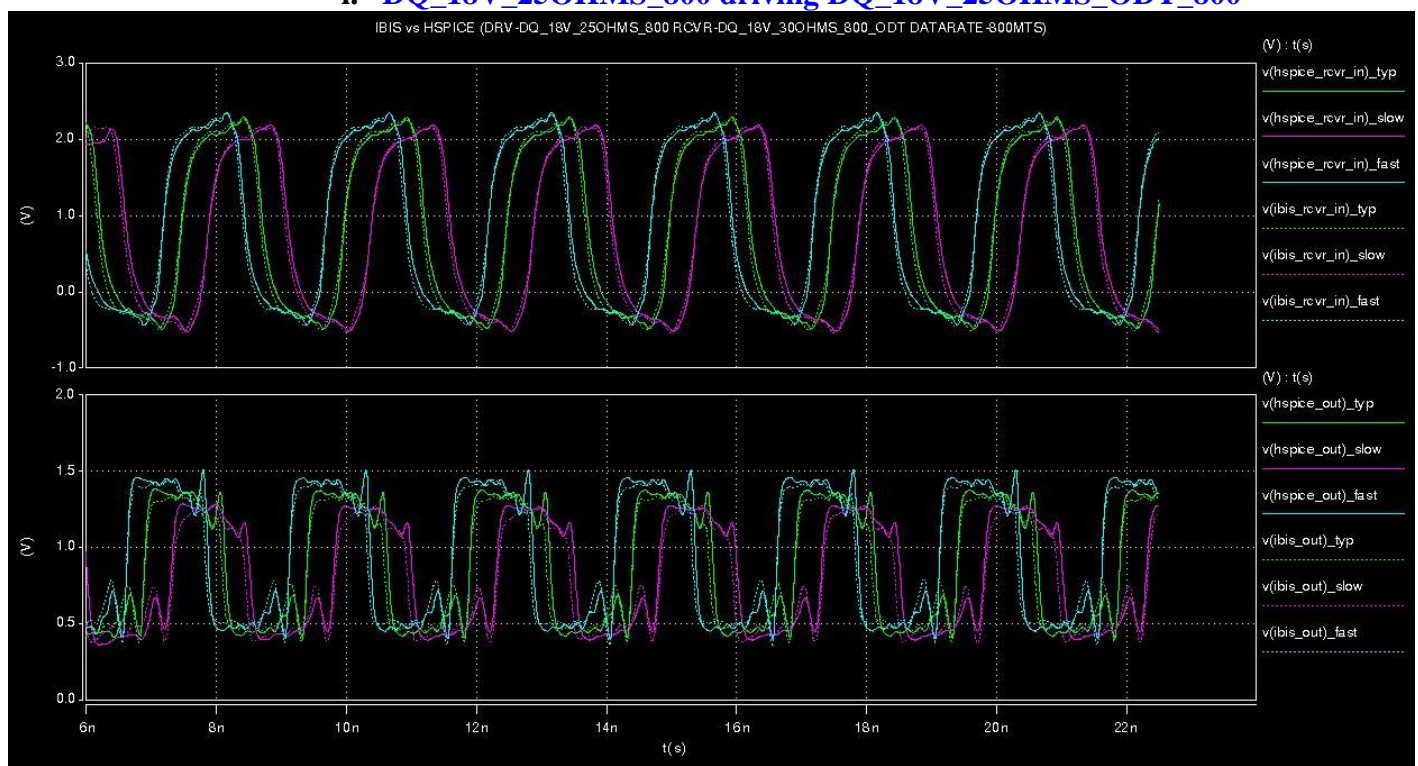
5. ☒ If ODT data is available from measurements, provide an IBIS and measurement comparison

	VCCQ	Model			Meas	
		TYP	SLOW	FAST	Min	Max
ODT	1.8	148	164	137	138	158

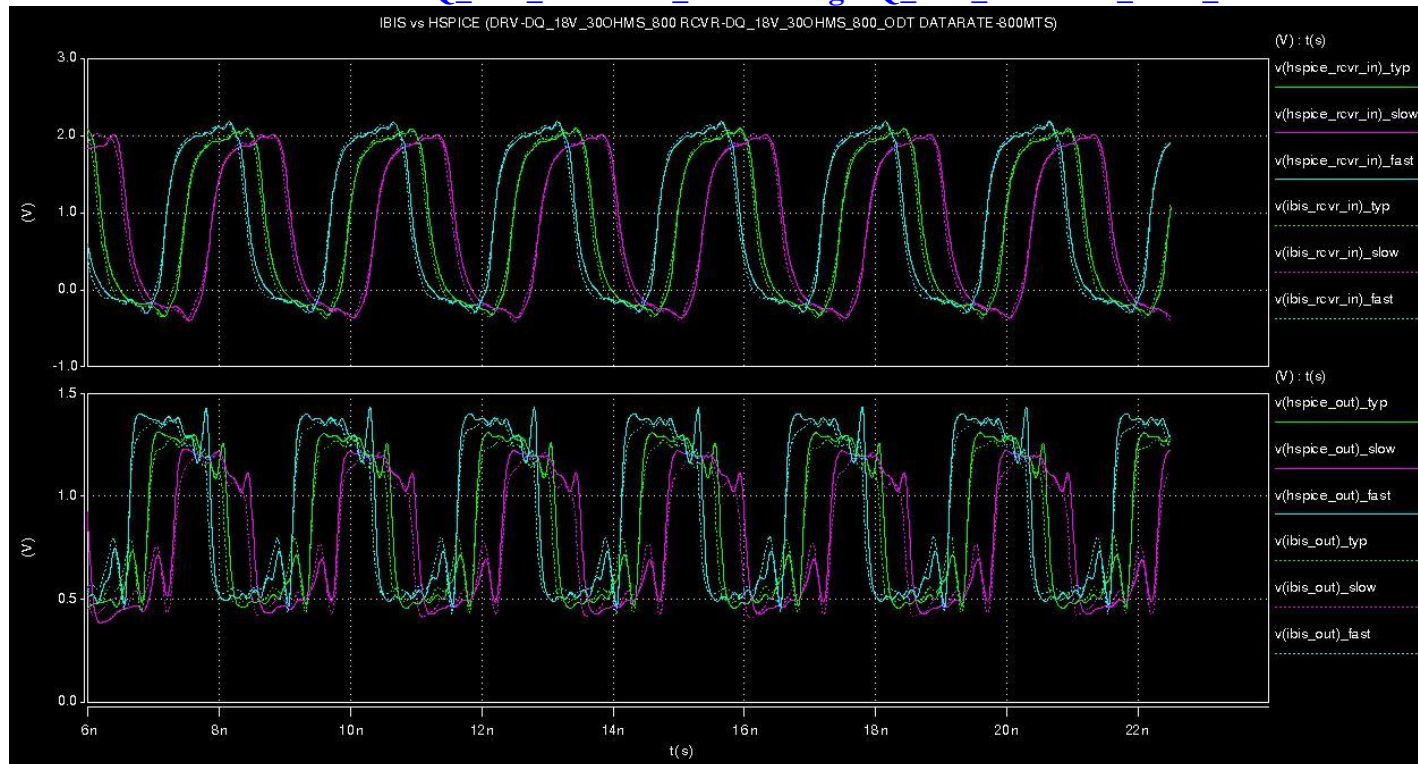
IBIS vs HSPICE Correlation

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

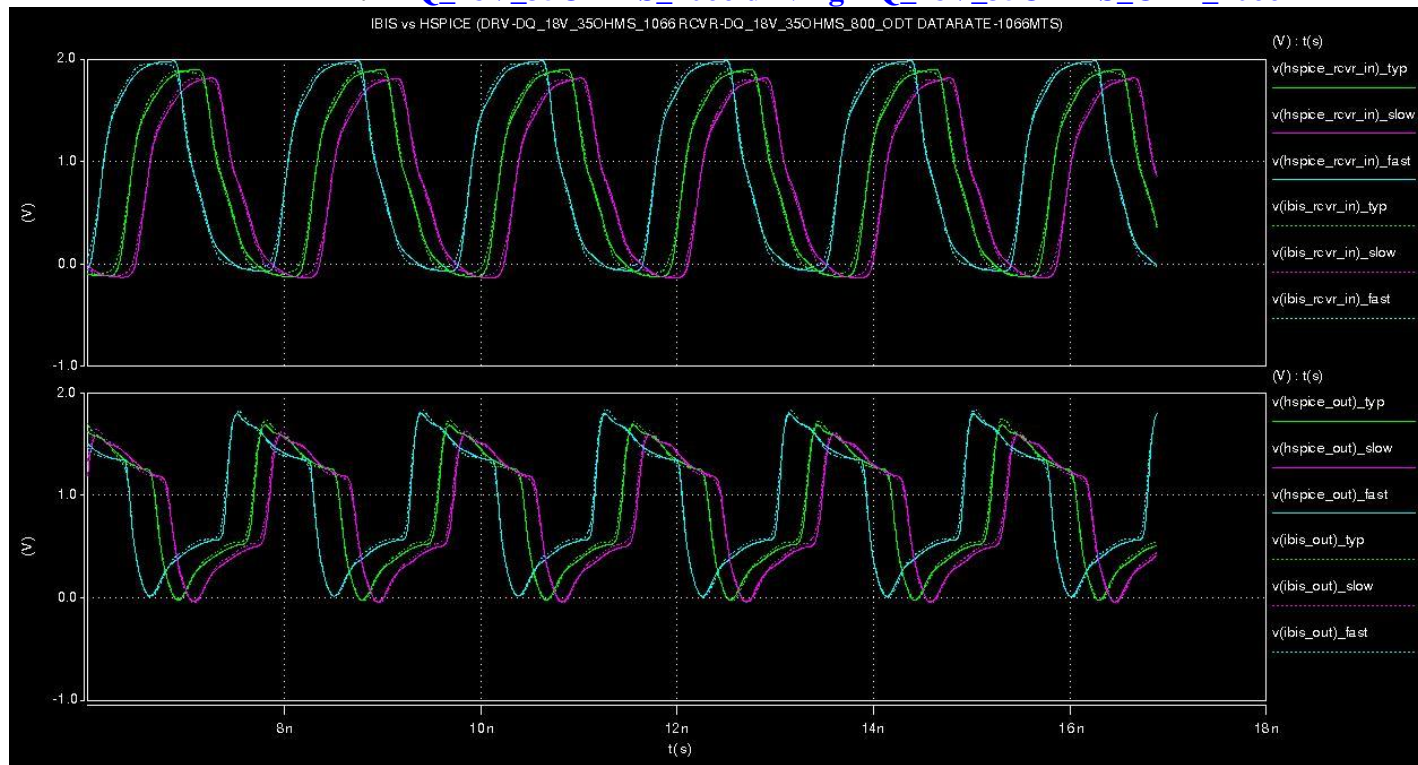
i. DQ_18V_250HMS_800 driving DQ_18V_250HMS_ODT_800



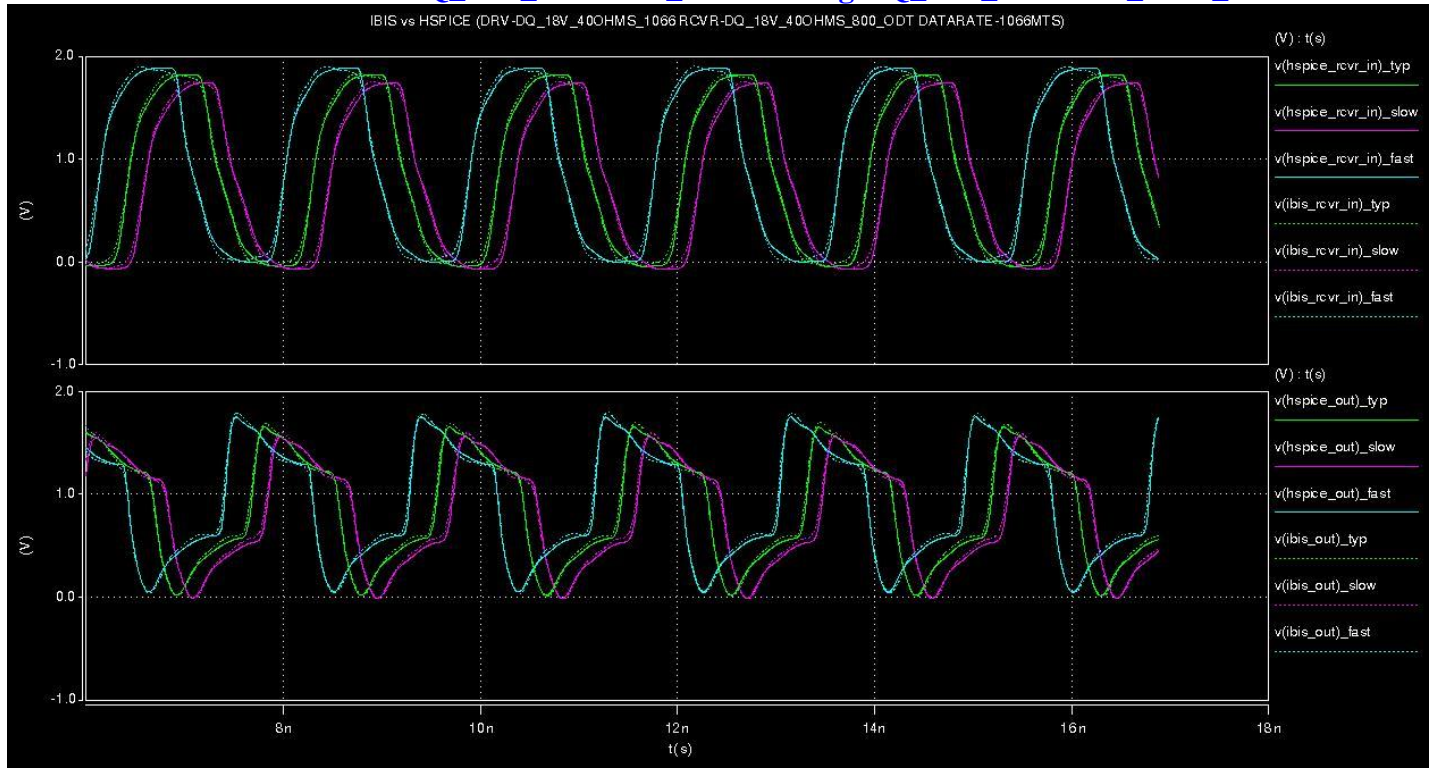
ii. DQ_18V_300HMS_800 driving DQ_18V_250HMS_ODT_800



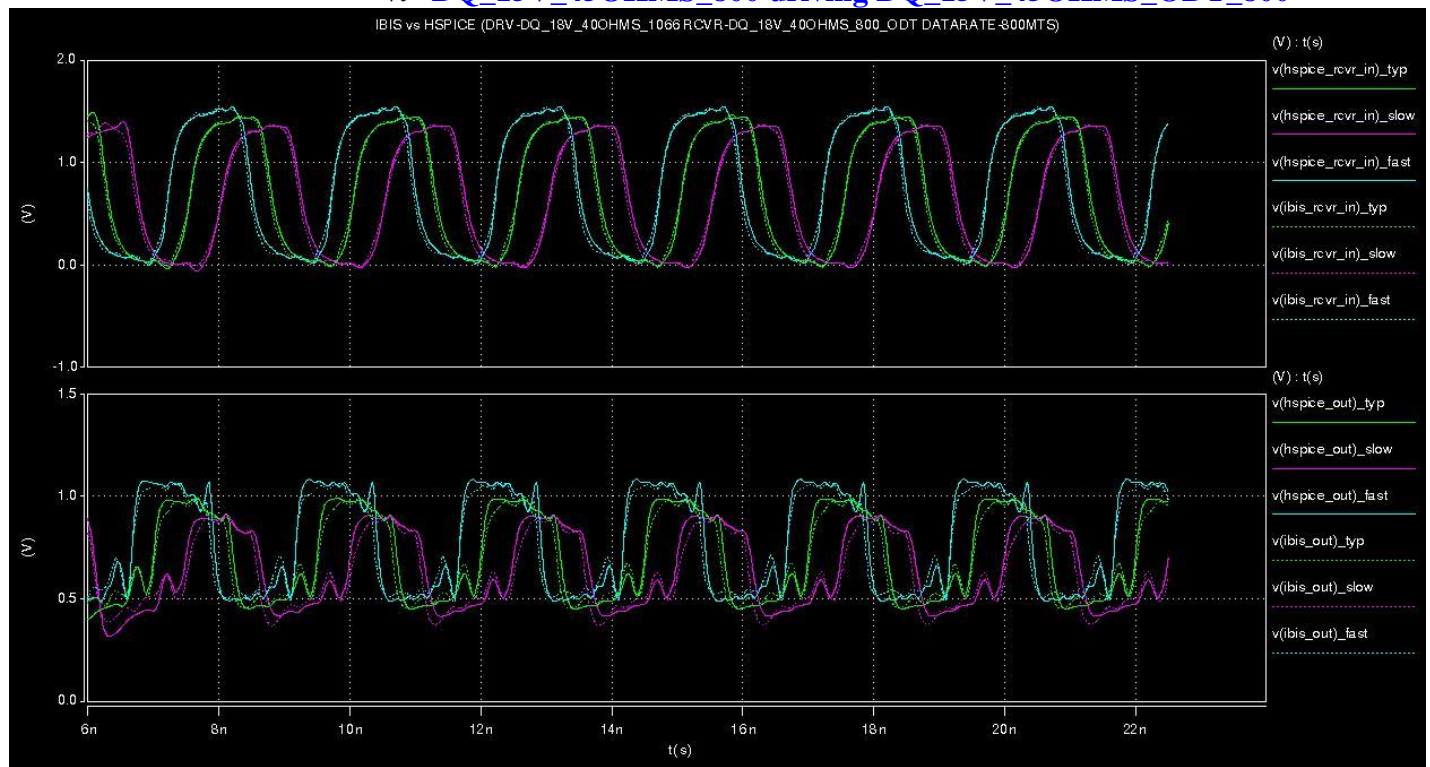
iii. DQ_18V_350HMS_1066 driving DQ_18V_350HMS_ODT_1066



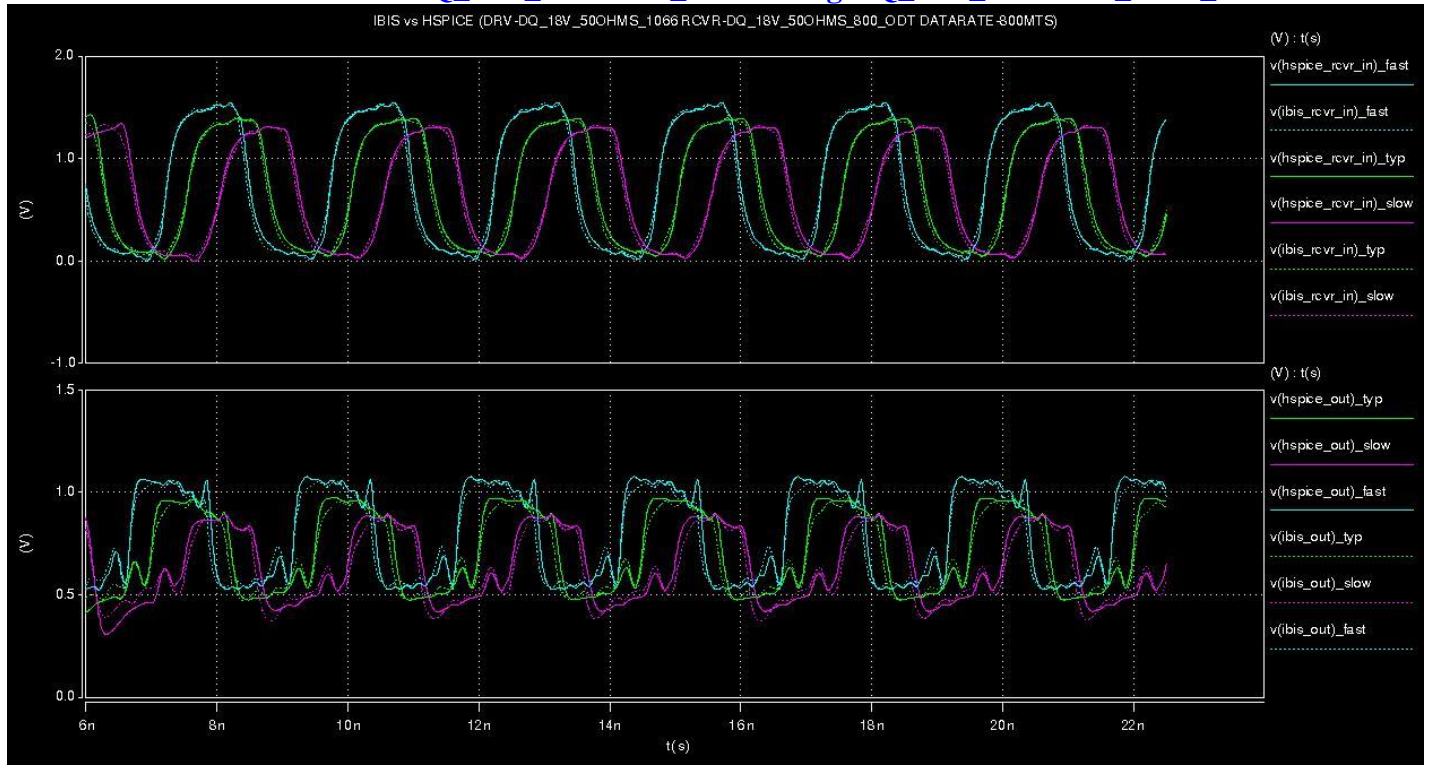
iv. DQ_18V_400HMS_1066 driving DQ_18V_400HMS_ODT_1066



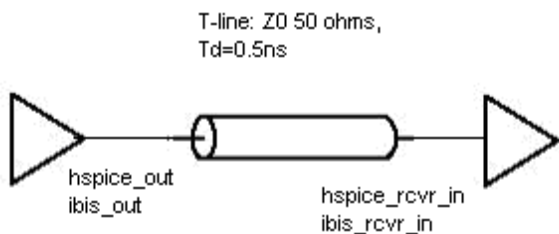
v. DQ_15V_450HMS_800 driving DQ_15V_450HMS_ODT_800



vi. DQ_15V_45OHMS_800 driving DQ_15V_45OHMS_ODT_800



Setup



Comments:

- 1) TDO simulation are done using hspice and uses adjusted process corners that match measurement die corner

Document Revision History

Rev 1.0 - Date 07/13/2010

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

Rev **2.0** - Date **05/05/2011**

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

Rev **2.3** - Date **07/27/2011**

- a. IBIS revision **2.3**
- b. HSpice revision **2.1**

Rev **2.4** - Date **08/23/2011**

- a. IBIS revision **2.4**
- b. HSpice revision **2.1**

Rev **2.5** - Date **08/12/2015**

- a. IBIS revision **2.5**
- b. HSpice revision **2.1**