cādence[®]

SPEED2000 EMI Simulation Tutorial

Product Version 16.6 July 2013

Document Updated on: June 6, 2013

© 2013 Cadence Design Systems, Inc. All rights reserved.

Cadence Design Systems, Inc. (Cadence), 2655 Seely Ave., San Jose, CA 95134, USA.

Open SystemC, Open SystemC Initiative, OSCI, SystemC, and SystemC Initiative are trademarks or registered trademarks of Open SystemC Initiative, Inc. in the United States and other countries and are used with permission.

Trademarks: Trademarks and service marks of Cadence Design Systems, Inc. contained in this document are attributed to Cadence with the appropriate symbol. For queries regarding Cadence's trademarks, contact the corporate legal department at the address shown above or call 800.862.4522. All other trademarks are the property of their respective holders.

Restricted Permission: This publication is protected by copyright law and international treaties and contains trade secrets and proprietary information owned by Cadence. Unauthorized reproduction or distribution of this publication, or any portion of it, may result in civil and criminal penalties. Except as specified in this permission statement, this publication may not be copied, reproduced, modified, published, uploaded, posted, transmitted, or distributed in any way, without prior written permission from Cadence. Unless otherwise agreed to by Cadence in writing, this statement grants Cadence customers permission to print one (1) hard copy of this publication subject to the following conditions:

- 1. The publication may be used only in accordance with a written agreement between Cadence and its customer.
- 2. The publication may not be modified in any way.
- Any authorized copy of the publication or portion thereof must include all original copyright, trademark, and other proprietary notices and this permission statement.
- 4. The information contained in this document cannot be used in the development of like products or software, whether for internal or external use, and shall not be used for the benefit of any other party, whether or not for consideration.

Disclaimer: Information in this publication is subject to change without notice and does not represent a commitment on the part of Cadence. Except as may be explicitly set forth in such agreement, Cadence does not make, and expressly disclaims, any representations or warranties as to the completeness, accuracy or usefulness of the information contained in this document. Cadence does not warrant that use of such information will not infringe any third party rights, nor does Cadence assume any liability for damages or costs of any kind that may result from use of such information.

Restricted Rights: Use, duplication, or disclosure by the Government is subject to restrictions as set forth in FAR52.227-14 and DFAR252.227-7013 et seq. or its successor.

Table of Contents

1	Intro	duction	4
	1.1	Overview	4
	1.2	Sample Case	4
2	Layo	ut Setup	5
	2.1	Loading Layout File	5
	2.2	Checking Stackup	5
	2.3	Selecting Nets	6
3	Simu	lation Setup	10
	3.1	Enabling Base Mode	10
	3.2	Assigning Capacitor Models	10
	3.3	Setting Up Circuits	12
	3.3.1	Setting Up Controller Model	12
	3.3.2	Setting Up Receiver Model	18
	3.3.3	Setting Up VRM	
	3.4	Generating Mesh	23
	3.5	Assigning Simulation Time	24
	3.6	Radiation	
	3.7	Checking Monitor Component Voltage	
4		g Files and Running Simulation	
	4.1	Saving File with Error Check	
	4.2	Running Simulation	
5	View	ing Results	30
	5.1	Viewing Time Domain Result	
	5.2	Viewing Radiation Result	30
	5.2.1	FCC Result	31
	5.2.2		-
	5.2.3	Near-Field Result	37

1 Introduction

This tutorial demonstrates how to use Electromagnetic Interference (EMI) mode in SPEED2000 to analyze the conducted and radiated noise from a DIMM memory module. It mainly introduces the setup of IBIS driver models for controller and memory.

1.1 Overview

The purpose of **EMI** workflow is to allow user to study the radiation from their designs. It lets user to study:

- Radiation versus frequency from the design
- Near-field E/H densities

The EMI workflow in SPEED2000 leads you to:

- Setup layout
- Setup simulation parameters
- Check errors
- Run simulation
- View results

1.2 Sample Case

The following three original files are used in this tutorial:

- SODIMM_EMI.spd layout file for SODIMM
- It is located in: <INSTALL_DIR>\SpeedXP\Samples\SPEED2000\EMI Simulation\Examples_PreSetup\
- dram.ibs IBIS file containing DRAM buffer models
- ctrl.ibs IBIS file containing Ctrl buffer models
- They are located in: <INSTALL_DIR>\SpeedXP\Samples\SPEED2000\EMI Simulation\Examples_PreSetup\IBIS\

And the completed sample and IBIS files (with step by step setup introduced in this tutorial) are also provided and located in:

 <INSTALL_DIR>\SpeedXP\Samples\SPEED2000\EMI Simulation\Examples_PostSetup\

2 Layout Setup

This chapter describes how to set up layout for EMI simulation.

2.1 Loading Layout File

- 1. Launch SPEED2000 Generator.
- 2. Select the EMI Simulation workflow.



3. Click Load Layout File to load .spd file.

2.2 Checking Stackup

This section leads you to set up the stackup and the parameters, which should be set correctly for each simulation.

1. Click Check Stackup in the Workflow pane.

The Layer Manager -> Stack Up window opens.

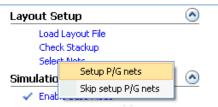
Stack Up			1	Later a	1			1	1
Layer #	Color	Layer Icon	Layer Name	Thickness(Material	Conductivity(S	Fill-in Dielectric	Permittivity	Loss T
			Medium\$40	0.1				1	0
1			Signal\$TOP	0.035		5.8e+007		[1]	[0]
			Medium\$42	0.106				4.5	0.035
2			Signal\$GND1	0.017		5.8e+007		[4.5]	[0.035]
			Medium\$44	0.17				4.5	0.035
3			Signal\$IN1	0.018		5.8e+007		[4.5]	[0.035]
			Medium\$46	0.4				4.5	0.035
4			Signal\$IN2	0.018		5.8e+007		[4.5]	[0.035]
			Medium\$48	0.17				4.5	0.035
5			Signal\$VDD	0.03048		5.959e+007		[4.5]	[0.035]
			Medium\$50	0.23			1	4.5	0.035
6			Signal\$IN3	0.03048		5.959e+007		[4.5]	[0.035]
			Medium\$52	0.23			1	4.5	0.035
7			Signal\$GND2	0.017		5.8e+007		[4.5]	[0.035]
			Medium\$54	0.106			1	4.5	0.035
8			Signal\$BOTTOM	0.035		5.8e+007		[1]	[0]
4			Madium#56	0.1	-		1	1	0
•			111						
Total Thickness: 1.8130e+000 m View Material Import									
						ſ	Auto Set Layer Spe		ilter

- 2. Check and edit the stackup as desired (no change in this example).
- 3. Click **OK** to exit the window.

2.3 Selecting Nets

This section leads you to classify and select the nets to be simulated. The power and ground nets need to be properly assigned in their respective groups before performing simulation.

1. Click Select Nets in the Workflow pane.



2. Click **Setup P/G nets** in the pop-up menu.

The P/G nets classification wizard opens.

Selec	t Components
Con	ponent
Ξ	
	<u> </u>
Ð	
	EEPROM_MASTER_TSSOP8-EEPROM_2KB_SERIAL_2K_1_8V
Ð	RESPACK4_MASTER-RESISTOR_NETWOF_22_Ohm
	- ^
	RESPACK4_MASTER-RESISTOR_NETWOH_10_Ohm
±	
±	
±	
±	

Tips

You can also open the **P/G nets classification wizard** by right-clicking a net in **Net Manager** and choosing Classify > P/G nets classification wizard....

3. Select **J1**, **D0**, and **D8**.

Select Components
Component
🗉 🗹 🤣 CTRL
🖸 🖉 🥔 J1
□ ↓ 200 □ Ø D4
□ Ø D6
🗖 🧼 D7
🗖 🖉 D9
🗹 🥔 DO
🛛 🗹 🥔 D8
■ □
RESPACK4_MASTER-RESISTOR_NETWOF_22_Ohm
RESPACK4_MASTER-RESISTOR_NETWOH_10_Ohm
E 🛛 🆃 V_source
✓ Filter components with number of pins >= 8 Update
< <u>Back</u> <u>N</u> ext > Cancel

4. Click Next.

The nets connected to a given component on more than one connection or ball are detected as potential Power or Ground nets.

-Pol	gn signal net to P/G net cential P/G nets connected to selected components are listed. me of those nets are not yet classified as P/G nets in Net Manager lassify them as P/G net, select those nets and use right click menu.
Po	tential P/G Nets
8	PowerNets VREF
	VDD
	VDDSPD
	🔀 GroundNets
	GND GND
	💋 Detected P/G nets

5. Click Next.

All the power and ground nets defined and generated are shown.

P/G Net List	Volt(V)	Paring P/G Net	
PowerNets			
VDDSPD			
🛛 🔀 GroundNets			
🗾 GND			

6. Click **Finish**.

The Net Manager automatically appears in the right pane.

Net N	lanager	×
Net:		- 2
	Show Volt & P/G	-
Net	List (Sort enabled first) $ riangle$ Volt (V) 🔺
[🗌 🕗 🌌 Unnamed Net(s)	
Θ	🗹 🌠 PowerNets	=
	🗹 🗹 VDD	
	🗖 🙋 🗾 VDDSPD	
	🗖 🙋 🗾 VREF	
	🗹 🏼 🌠 GroundNets	
	🗹 🗾 GND	

7. Check the signal nets: DQ0~DQ7, DQ0R~DQ7R, DQS0+, DQS0R+, DQS0-, and DQS0R-.

Net List(S	ort enabled first) 🔺	Volt (V)	Paring P/(📥
	💹 Unnamed Net(s))	
	💋 PowerNets		
	🖊 VDD		=
	📿 🗾 VDDSPD		
	🙆 🖊 VREF		
⊟ 🗹	🔀 GroundNets		
\checkmark	🗾 GND		
\checkmark	🗾 DQ0		
\checkmark	🗾 DQOR		
\checkmark	🗾 DQ1		
\checkmark	🗾 DQ1R		
\checkmark	🗾 DQ2		
\checkmark	🗾 DQ2R		
	DQ3		
\checkmark	🗾 DQ3R		
\checkmark	🗾 DQ4		
\checkmark	🗾 DQ4R		
\checkmark	🖊 DQ5		
	🗾 DQ5R		
	🗾 DQ6		
	DQ6R		
	🗾 DQ7		
	🗾 DQ7R		
	DQ50+		
	🗾 DQ50-		
	DQS0R+		
- 🗹	DQS0R-		
	A0		
	AOR		
	A1		
	AIR		
	✓ A2		
	A2R		
	A3		
	🖊 A3R		
	A4 A4R		
	A4R		
	AS ASR		-
 □ □ □ 	ASR		•
General			
	hape enabled when	the net is dis-	abled
Gray D			de Disabled

All the **DQ** and **DQS** signal nets connected to **U0** and **U8** are enabled.

3 Simulation Setup

3.1 Enabling Base Mode

The EMI analysis relies on the base analysis mode. It is similar to other analysis performed in the base mode. The only difference is to enable the storage of radiation results and potentially add probes in locations that typically would not be probed in a signal integrity-only context.

Click Enable Base Mode in the Workflow pane before setting up other simulation options.

Enable Base Mode

When enabled, a check mark \checkmark appears next to the workflow step.

3.2 Assigning Capacitor Models

There are two ways to assign spice models to capacitors in SPEED2000:

- Entering the capacitor netlist on the fly
- Importing a library directly

This section introduces how to assign spice models to all relevant capacitors with the first method.

1. Choose Setup > Circuit/Linkage Manager....

The Circuit/Linkage Manager opens.

Circuit/Linkage Manager	×
	- 9
Ckt Name	🛆 🛛 Model Name 📥
🗸 🖪 C2	CAPACI
🗸 🖪 C4	CAPACI 🔗
🗸 🖪 C7	🔷 CAPACI
🗸 🖪 С9	CAPACI 🔗
✓ A C10	
A C11	CAPACI
✓ 🛆 C13	
A C14	CAPACI
C16 A C17	CAPACI
A C17 A C18	
✓ A C18	
	CAFACI
New Del Edit	Load Filter 🍸
Ckt Node 🛆 Pkg Node	
CKC NODE Z PKg NODE	Layer Na
▲	
Link Unlink	

- 2. Select C2.
- 3. Click Edit.

The Edit Definition dialog box appears.

Definition Type Partial Circuit Type ● Partial Circuit ● Sub-circuit ● Model ● SpeedXP ● HSPICE Name : CAPACITORS_MASTER-CAPACITOR_22D_220nF External Nodes : 1 2 Definition : ● New Edit ● Delete C 1 2 220nF ● Model File Type: ▼ File Name : ○ Component Name: Edit IBIS ● Delete IBIS Header/Footer Info : ♥ Read-Only ExtNode = 1 2 ● ••••••••••••••••••••••••••••••••••••	Edit Definition	- 🗆 X
Edit IBIS Delete IBIS Header/Footer Info : Image: Read-Only ExtNode = 1 2 Image: Read-Only	Definition Type: • Partial Circuit • Sub-circuit • Model Name : CAPACITORS_MASTER-CAPACITOR_22D_220nF External Nodes : 1 2	Partial Circuit Type SpeedXP OHSPICE Local Parameters : Global Parameter Name Value New Edit Delete Model File Type:
		Component Name: Edit IBIS Header/Footer Info : Read-Only ExtNode = 1 2 ***********************************

- 4. Define a simple ideal capacitor as:
 - Name: CAPACITORS_MASTER-CAPACITOR_22D_220nF
 - External Nodes: 1 2
 - Definition: C 1 2 220nF
- 5. Click OK.

The **SPEED GENERATE** dialog box appears, showing all capacitors with the same part number or model name are updated to use the given model.

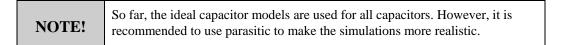
SPEED GENERATOR X	
The model definition is changed for the following circuits : C10 C11 C16 C17 C18 C19 C2 C20 C23 C26 C33 C36 C38 C40 C41 C46 C50 C56 C61 and more	

6. Click **OK**.

A dialog box prompts to ask you whether to enable other related circuits.

E	Enable related Circuits	×
	The following circuits are not enabled. Do you want to enable them now? C11 C17 C18 C20 C26 C33 C38 C46 C60 C61 C62	
	OK Cancel	

- 7. Click OK.
- 8. Repeat Step 2 to 5 to define models for all the capacitors in this design.



3.3 Setting Up Circuits

This section defines the controller and memory device models based on the IBIS models. The design is set up in a write mode, that is, the controller is writing to the memories running at DDR3-1333 speed.

3.3.1 Setting Up Controller Model

1 Choose Setup> Circuit/Linkage Manager....

The Circuit/Linkage Manager window opens.

2 Select **J1**.

						- 5	D
4	Ckt Na	me	Mod	el Name	T	ags	
Α	D7		🤣 C	RAM			
Α	D8		🤣 C	RAM			
	D9		🧼 C	RAM			
	D10			RAM			
	D11			RAM			
	D12			RAM			
	D13			RAM			
	D14			RAM			
	D15			RAM			
				EPROM			1
_ <u>A</u>	IC2			EPROM			=
	J1			TRL			_
_	R1			RESISTOR			
8				RESISTOR			
- [2]				RESISTOR			
_ <u>A</u>				ESISTOR			
A	R11		· · ·	ESISTOR			
	R12 R13			RESISTOR			
	R13 R14			RESISTOR			Ļ
< □	R14	1		COLOR		•	
3	New	Del	Edit	Load	Filte	r S	7
Ckt N	ode 🛆	Pkg Noc	le	Layer N	ame		-
1		Node1	3339!	Signal\$1	OP		1
2		Node1	0398!	Signal\$B	OTTO	4	
3		Node1	0395!	Signal\$1	OP		
4		Node1	1585!	Signal\$B	OTTO	4	
5		Node1	15801	Signal\$1	'OP		*
Link		Inlink					

3 Click the **Edit** button.

lit Definition							- 0
 Definition Type Partial Circu 	iit	O Sub-circi	uit	O Model	Partial Circ Speed	İXP	O HSPICE
Name : CTRL	200 198 196 188 186 184 176 174 172 164 162 160	182 180 170 168	178 166		Name New Model File Type: File Name : Component Edit IB1 Header/Fool	Value Edit	Global Paramete

The Edit Definition window opens

4 Select **IBIS- I/O Buffer Information Specification** from the **Model File Type** drop-down menu.

lit Definition							Partial Cir	cuit Type	_ 🗆
 Partial Circ 	uit	0	Sub-circ	uit	Ом	odel	⊙ Spee	dXP	OHSPICE
Name : CTRL							Local Paran	neters :	Global Parameter
External Nodes :	200 198 188 186 176 174	196 19 184 18 172 17	2 180	190 178 166			Name	Value	
Definition :	164 162		8 156			-	New Model File	Edit	Delete
							Compoi CP	D - Electrical Board	onnection Protocol ower Model
							Edit IB Header/Foo		Delete IBIS
							+ 180 178 + 140 138	176 174 172 170 136 134 132 130	194 192 190 188 168 166 164 162 128 126 124 122 84 82 80 78 76 7
							0	ĸ	Cancel

5 Click the Edit IBIS button.The Pin Editor: J1 / CTRL window opens.

Pin	Linkage	Pulldown	Pullup	GND Clamp	Power Clamp	Signal name	Model	Polari
		111						

6 Click the browse button *and* select the file **ctrl.ibs** for **J1**.

The **Pin Editor** field is updated with the IBIS component information.

104 104 11 11 111 112 112 117 118 118	104 <==> 11 <==> 111 <==> 112 <==>	Node9899!!103::V Node9902!!104::V Node11517!!11::DO Node9896!!111::V Node9893!!112::V	D NC 25Ground D NC	Power1 Power1 Power1 Power1	NC NC Ground	Power1 Power1 Power1	VDD VDD	POWER POWER	Non-Inve Non-Inve
11 V 111 V 112 V 117 V 118 V	11 <==> 111 <==> 112 <==>	Node11517!!11::DO Node9896!!111::V	25Ground DINC	Power1					Non-Inve
111 112 112 117 118 118	111 <==> 112 <==>	Node9896!!111::V	DNC		Ground	Power1			
111 112 112 117 118 118	112 <==>			Power1		LOMOLT	DQS0-	data_odtoff :: dat	a Non-Inve
117 🗹		Node9893!!112::V		1 01101 1	NC	Power1	VDD	POWER	Non-Inve
118 🗹	117 <==>		DINC	Power1	NC	Power1	VDD	POWER	Non-Inve
		Node9887!!117::V	D NC	Power1	NC	Power1	VDD	POWER	Non-Inve
	118 <==>	Node9890!!118::V	DINC	Power1	NC	Power1	VDD	POWER	Non-Inve
12 🗹	12 <==>	Node10405!!12::GN	IC Ground	NC			GND	GND	Non-Inve
121	121 <==>	Node10470!!121::	G Ground	NC			GND	GND	Non-Inve
122 🗹	122 <==>	Node10467!!122::	G Ground	NC			GND	GND	Non-Inve
127 🗹	127 <==>	Node10500!!127::	G Ground	NC			GND	GND	Non-Inve
128 🗹	128 <==>	Node10497!!128::	G Ground	NC			GND	GND	Non-Inve
13 🗹	13 <==>	Node11491!!13::DC	25Ground	Power1	Ground	Power1	DQS0+	data_odtoff :: dat	a Non-Inve
132 🗹	132 <==>	Node10491!!132:	G Ground	NC			GND	GND	Non-Inve
									>

- 7 Define the stimulus for the controller **DQ** and **DQS** signals, assuming that all signals toggle in phase with a 1010.. pattern.
 - 7.1 Click the **Signal Name** column to rank the signals, which makes it easier to identify **DQ** signals.
 - 7.2 Click the blank cell in the **Stimulus** column.

The Stimulus Signals: box appears in the lower right corner.

Pulldown	Pullup	GND Clamp	Power Clamp	🔺 Signal name 🗠	Model	Polarity	Stimulus	Enable	Sgn Mon	Pwr Mon	
ound	Power1	Ground	Power1	DQ0	data_odtoff :: dat	a Non-Inverting					П
ound	Power1	Ground	Power1	DQ1	data_odtoff :: dat	a Non-Inverting					
ound	Power1	Ground	Power1	DQ2	data_odtoff :: data	a Non-Inverting					
ound	Power1	Ground	Power1	DQ3	data_odtoff :: dat	a Non-Inverting					
ound	Power1	Ground	Power1	DQ4	data_odtoff :: dat	a Non-Inverting					
ound	Power1	Ground	Power1	DQ5	data_odtoff :: dat	a Non-Inverting					
ound	Power1	Ground	Power1	DQ6	data_odtoff :: dat	a Non-Inverting					
ound	Power1	Ground	Power1	DQ7	data_odtoff :: dat	a Non-Inverting					
und	Power1	Ground	Power1	DQS0+	data_odtoff :: dat	a Non-Inverting					
ound	Power1	Ground	Power1	DQS0-	data_odtoff :: dat	a Non-Inverting					
ound	NC			GND	GND	Non-Inverting					
ound	NC			GND	GND	Non-Inverting					
und	NC			GND	GND	Non-Inverting					
und	NC			GND	GND	Non-Inverting					
ound	NC			GND	GND	Non-Inverting					
und	NC			GND	GND	Non-Inverting					
und	NC			GND	GND	Non-Inverting					

7.3 Select New... for Stimulus Signals from the drop-down menu.



The New Definition window opens.

New Definition			-	
O Partial Circuit	⊙ Sub-circuit	O Model	Partial Circuit Type SpeedXP OHS	PICE
Name :			Local Parameters : Global Pa	arameter
External Nodes :			Name Value	
Definition :			New Edit	Delete
			Model File Type:	-
			File Name :	
			Edit IBIS Delet	te IBIS
			Header/Footer Info :	ead-Only
			ок	ancel

7.4 Input the following:

- Name: data_in
- External Nodes: 1 2
- Definition:

Vin 1 2 digital_ramp(0 1 750p 0 10p 10p)

+pattern=(1,0,1,0,1,0,1,0,1,0,1,0,1,0,1,0)

Edit Definition				- 🗆 X
O Partial Circuit	⊙ Sub-circuit	O Model	Partial Circuit Type SpeedXP Local Parameters :	O HSPICE
Name : data_in External Nodes : 1 2			Name Value	Gibbai Paraineter
Definition : Vin 1 2 digital_ramp(0 1 750p + pattern=(1,0,1,0,1,0,1,0,1	0 10p 10p) ,0,1,0,1,0,1,0)		New Edit Model File Type: File Name : Component Name:	Delete
			Edit IBIS Header/Footer Info :	Delete IBIS
			▼ 1 2 ***********************************	
			ОК	Cancel

7.5 Click **OK**.

The new stimulus circuit **data_in** is created.

- 7.6 Assign signals **DQ0~DQ7** with **data_in**.
- 8 Repeat Step **7.2** to **7.6** to create new stimulus circuit with opposite polarity for **DQS**+ with the following:

Name: dqs_in_pos

External Nodes:1 2

Definition:

Vin 1 2 digital_ramp(0 1 750p 375p 10p 10p)

+pattern=(1,0,1,0,1,0,1,0,1,0,1,0,1,0,1,0)

Edit Definition				- 🗆 ×
Definition Type	O Sub-circuit	O Model	Partial Circuit Type • SpeedXP	O HSPICE
Name : dqs_in_pos External Nodes : 1 2 Definition : Vin 12 digital_ramp(0 1 750p +pattern=(1,0,1,0,1,0,1,0,1)	350p 10p 10p) ,0,1,0,1,0,1,0)		Local Parameters : Name Value New Edi Model File Type: File Name : Component Name : Edit IBIS Header/Footer Info : + 1 2	Global Parameter Global Parameter t Delete
			•*************************************	Cancel

9 Repeat Step **7.2** to **7.6** to create new stimulus circuit with opposite polarity for DQS-: with the following:

Name: dqs_in_neg

External Nodes: 1 2

Definition:

Vin 1 2 digital_ramp(0 1 750p 375p 10p 10p)

+pattern=(0,1,0,1,0,1,0,1,0,1,0,1,0,1,0,1)

10 Select **DQ0~DQ7**, **DQS0+**, and **DQS0-**.

11 Select data_odtoff in the column of Model, and Output in the column of Enable.

Pulldown	Pullup	GND Clamp	Power Clamp	🔺 Signal name	Model	Polarity	Stimulus	Enable	Sgn Mon	Pwr Mon	
und	Power1	Ground	Power1	DQ0	data_odtoff :: data	Non-Inverting	data_in	Output			
und	Power1	Ground	Power1	DQ1	data_odtoff :: data	Non-Inverting	data_in	Output			=
und	Power1	Ground	Power1	DQ2	data_odtoff :: data	Non-Inverting	data_in	Output			
und	Power1	Ground	Power1	DQ3	data_odtoff :: data	Non-Inverting	data_in	Output			-
und	Power1	Ground	Power1	DQ4	data_odtoff :: data	Non-Inverting	data_in	Output			
und	Power1	Ground	Power1	DQ5	data_odtoff :: data	Non-Inverting	data_in	Output			
und	Power1	Ground	Power1	DQ6	data_odtoff :: data	Non-Inverting	data_in	Output			
und	Power1	Ground	Power1	DQ7	data_odtoff :: data	Non-Inverting	data_in	Output			
und	Power1	Ground	Power1	DQS0+	data_odtoff :: data	Non-Inverting	dqs_in_pos	Output			
und	Power1	Ground	Power1	DQS0-	data_odtoff :: data	Non-Inverting	dqs_in_neg	Output			
und	NC			GND	GND	Non-Inverting					
und	NC			GND	GND	Non-Inverting					
und	NC			GND	GND	Non-Inverting					
und	NC			GND	GND	Non-Inverting					
und	NC			GND	GND	Non-Inverting					
und	NC			GND	GND	Non-Inverting					
und	NC			GND	GND	Non-Invertina					

12 Check Pwr Mon.

IBIS\ctrl.ibs								Component :	DDR3_1		
Pulldown	Pullup	GND Clamp	Power Clamp	🔺 Signal name/	Model	Polarity	Stimulus	Enable	Sgn Mon	Pwr Mon	
Ground	Power1	Ground	Power1	DQ0	data_odtoff :: ·	Non-Inverting	data_in	Output		\checkmark	T
Ground	Power1	Ground	Power1	DQ1	data_odtoff :: •	Non-Inverting	data_in	Output		\checkmark	
Ground	Power1	Ground	Power1	DQ2	data_odtoff :: •	Non-Inverting	data_in	Output		\checkmark	
Ground	Power1	Ground	Power1	DQ3	data_odtoff :: •	Non-Inverting	data_in	Output		\checkmark	
Ground	Power1	Ground	Power1	DQ4	data_odtoff :: (Non-Inverting	data_in	Output		<u>.</u>	
Ground	Power1	Ground	Power1	DQ5	data_odtoff :: •	Non-Inverting	data_in	Output		$\overline{}$	
Ground	Power1	Ground	Power1	DQ6	data_odtoff :: •	Non-Inverting	data_in	Output		$\overline{}$	
7Ground	Power1	Ground	Power1	DQ7	data_odtoff :: •	Non-Inverting	data_in	Output		$\mathbf{\nabla}$	
Ground	Power1	Ground	Power1	DQS0+	data_odtoff :: •	Non-Inverting	dqs_in_pos	Output			
Ground	Power1	Ground	Power1	DQS0-	data_odtoff :: •	Non-Inverting	dqs_in_neg	Output		\checkmark	
Ground	NC			GND	GND	Non-Inverting					
Ground	NC			GND	GND	Non-Inverting					
Ground	NC			GND	GND	Non-Inverting					
Ground	NC			GND	GND	Non-Inverting					
Ground	NC			GND	GND	Non-Inverting					
Ground	NC			GND	GND	Non-Inverting					
Ground	NC			GND	GND	Non-Invertina					1
alound						111					

After all the settings, the green signs appear ahead of the selected signals.

Pin	Linkage	Pulldown	Pullup	GND Clamp	Power Clamp	🔺 🔺 Signal name	Model	Polarity	Stimulus	
5		Ground	Power1	Ground	Power1	DQ0	data_odtoff ::	cNon-Inverting	data_in	Outp
7		Ground	Power1	Ground	Power1	DQ1	data_odtoff ::	cNon-Inverting	data_in	Outp
17	✓17 <==> Node11417!!17::DQ	2Ground	Power1	Ground	Power1	DQ2	data_odtoff ::	cNon-Inverting	data_in	Outp
19	✓19 <==> Node11370!!19::DQ	Ground	Power1	Ground	Power1	DQ3	data_odtoff ::	cNon-Inverting	data_in	Outp
4 6 14	✓4 <==> Node11585!!4::DQ4	Ground	Power1	Ground	Power1	DQ4	data_odtoff ::	cNon-Inverting	data_in	Outp
6	✓6 <==> Node11576!!6::DQ5	Ground	Power1	Ground	Power1	DQ5	data_odtoff ::	cNon-Inverting	data_in	Outp
14	✓14 <==> Node11471!!14::DQ	EGround	Power1	Ground	Power1	DQ6	data_odtoff ::	cNon-Inverting	data_in	Outp
16	✓16 <==> Node11429!!16::DQ	7Ground	Power1	Ground	Power1	DQ7	data_odtoff ::	cNon-Inverting	data_in	Outp
13	✓13 <==> Node11491!!13::DQ	Ground	Power1	Ground	Power1	DQS0+	data_odtoff ::	cNon-Inverting	dqs_in_pos	Outp
13 11	✓11 <==> Node11517!!11::DQ	SGround	Power1	Ground	Power1	DQ50-	data_odtoff ::	cNon-Inverting	dqs_in_neg	Outp
127	✓127 <==> Node10500!!127::0	5 Ground	NC			GND	GND	Non-Inverting		
128	✓128 <==> Node10497!!128::0	5 Ground	NC			GND	GND	Non-Inverting		
122	✓122 <==> Node10467!!122::0	5 Ground	NC			GND	GND	Non-Inverting		
132	✓132 <==> Node10491!!132::0	5 Ground	NC			GND	GND	Non-Inverting		
133	✓133 <==> Node10494!!133::0	5 Ground	NC			GND	GND	Non-Inverting		
138	✓138 <==> Node10485!!138::0	5 Ground	NC			GND	GND	Non-Inverting		
121	■121 <==> Node10470!!121::0	Ground	NC	111		GND	GND	Non-Invertina		

13 Click OK.

A dialog box prompts to confirm that the model definition is changed.

SPEED GE	INERATOR X
į	The model definition is changed for the following circuit : J1
	ОК

14 Click OK.

3.3.2 Setting Up Receiver Model

- Choose Setup > Circuit/Linkage Manager.... The Circuit/Linkage Manager window opens.
- 2. Select **D0**.

	Ckt Name	Model Name	Tags	X(mm)	Y(rr 🗠
А	C62	🔷 CAPACITO			
А	C92	🛷 CAPACITO			
	C93	CAPACITO			
А	D0	🛷 DRAM			
	D1	🋷 DRAM			
	D2	🋷 DRAM			
	D3	🋷 DRAM			
	D4	🛷 DRAM			
	D5	🋷 DRAM			=
	D6	🛷 DRAM			
	D7	🋷 DRAM			
	D8	🛷 DRAM			
	D9	🛷 DRAM			
	D10	🛷 DRAM			
А		🌏 DRAM			
А		🋷 DRAM			
	D13	🋷 DRAM			
	DIA				

3. Click the **Edit** button.

The **Edit Definition** window opens.

dit Definition									- 0
Definition Type Partial Circo	uit	O Sub-cin	cuit	OM	1odel		Partial Circ Speed Local Parame	XP	O HSPICE
Name : DRAM			M7 J7 R2				Name	Value	
Definition :	P3 P2 N3	N2 M3 M2	13			•	New Model File Type:	Edit	Delete
							File Name : Component		
							Edit IBI:	er Info :	Read-Only
							+ K7 K8 K9 + K2 K1 J3		18 H9 R3 R2 P3 P 11 L1 L9 M9 R9 N
							ОК]	Cancel

4. Select **IBIS- I/O Buffer Information Specification** from the **Model File Type** drop-down menu.

Definition Type	Partial Circuit Type
O Partial Circuit O Sub-circuit O Model	SpeedXP OHSPICE
ame : DRAM xternal Nodes : R7 R8 P7 P8 N7 N8 M7 M6 L7 L8 K7 K8 K9 J7 J8 J9 H7 H8 H9 R2 R2 P3 P2 N3 N2 M3 M2 L3 efinition :	Local Parameters : Global Parameter Name Value New Edit Delete Model File Type: CPM - Apache Chip Power Model File Nar Ebb = 1/G Buffer: Information Specification Ebb = 1/G Buffer: Information Specification File Nar Ebb = 1/G Buffer: Information Specification CPM - Apache Chip Power Model HayCe - HSPICE Net List Delete CPM Header/Footer Info : Image: Read-Only + ExtNode = R7 R8 P7 P8 N7 N8 M7 M8 L7 L8 + K7 K8 K9 37 J8 39 H7 H8 H9 R3 R2 P3 P2 N3 N2 K6 E + K7 K1 33 22 H18 42 H11 L1 L9 M9 R9 N9 S2 S3 S1 E + T7 T8 T9 U2 U3 U1 U7 U8 P1 M1 III

 Click the Edit IBIS button. The Pin Editor: D0 / DRAM window opens.

Pin	Linkage	Pulldown	Pullup	GND Clamp	Power Clamp	Signal name	Model	Polarity	Stimulus
				111					
		O Pin RLC							

6. Click the browse button *and* select the file dram.ibs for **D0**.

H1 <==> Node10303!!H1::VD	ENC	Power1							
			NC	Power1	VDD	Power	Non-Inverting		
✓H3 <==> Node10763!!H3::GN		NC	Ground1	NC	GND	Gnd	Non-Inverting		
							2		
							2		
							-		
							-		
							-		
							~		
							-		
							-		
✓L1 <==> Node1151!!L1::DO7	R Ground1	Power1		Power1	DO7R	DO 34 1333 :: DO	Non-Invertina		D
	Image: Constraints Image: Constraints Image: Constraints Image: Constants Image: Constraints	Pirst c==> Node1076/81173:13/NLGround1 Pirt c==> Node1076/1173:13/NLGround1 Pirst c==> Node1076/1173:13/NLGround1 Pirst c==> Node1018/1193:10/QSR/Ground1 Pirst c==> Node107511122:15/ND/Ground1 Pirst c==> Node10751123:15/ND/Ground1 Pirst c==> Node10751123:15/ND/GR/Ground1 Pirst c==> Node10751123:15/ND/NC Pirst c==> Node10281181:10/DD/NC Pirst c==> Node10281183:10/DD/NC Pirst c==> Node100281183:10/DD/NC Pirst c==> Node100281183:10/DD/NC Pirst c==> Node100281183:10/DD/NC Pirst c==> Node100281183:10/DD/NC Pirst c==> Node1010281187:10/DD/NC Pirst c==> Node1010181189:10/DD/NC Pirst c==> Node1010181189:10/DD/NC Pirst c==> Node1010181189:10/DD/NC Pirst c==> Node1010181189:10/DD/NC Pirst c==> Node1010181189:10/DD/NC	IF7 <==> Node107781H7::GNLGround1 NC IF8 <==> Node10161H8::DQS(Ground1 Power1 IF8 <==> Node10131H8::DQS(Ground1 Power1 IF1 <==> Node10131H8::DQS(Ground1 Power1 IF1 <==> Node10131H8::DQS(Ground1 Power1 IF2 <==> Node10781H2::GND Ground1 Power1 IF3 <==> Node10781H3::GND Ground1 Power1 IF3 <==> Node10781H3::GND Ground1 Power1 IF4 <==> Node103251H1::YDDNC Power1 IF4 <==> Node103251H1::YDDNC Power1 IFX <==> Node10325HK1::YDDNC Power1 IFX <==> Node10325HK1::YDDNC Power1 IFX <==> Node1031H8::DQ1FGround1 Power1 IFX <==> Node1031H8::DQ1FGround1 Power1 IFX <==> Node100161H8::DQ1FGround1 Power1 IFX <==> Node100161H8::DQ1FGround1 Power1	Pit7 > Node107781H7::GNLGround1 NC Ground1 PiH8 > Node101031H89::DQSGround1 Power1 Ground1 PiH8 > Node101031H89::DQSGround1 Power1 Ground1 PiH8 > Node101031H89::DQSGround1 Power1 Ground1 PiH8 > Node101031H89::DQSG Ground1 Power1 Ground1 Pit8 > Node10761H132::GND Ground1 Power1 Ground1 Pit8 > Node107751H33::GND Ground1 NC Ground1 Pit8 > Node1047191130::GND Ground1 NC Ground1 Pit8 > Node1047191130::GND Ground1 NC Ground1 Pit8 > Node1041171::DQSG Ground1 Power1 Ground1 Pit8 > Node1041171::DQSG Ground1 Power1 NC Pit8 > Node1025H1K1::DDNC Power1 NC Pit8 > Node10025H1K2::DQFGround1 Power1 NC Pit8 > Node10205H1K3::DQIFGround1 Power1 NC Pit8 > Node10016H1K8::DQIFGround1 Power1 Ground1	DH7 <==> Node1077811H7::GNCGround1 NC Ground1 NC DH8 ==> Node101611H9::DQCGround1 Power1 Ground1 Power1 D14 c==> Node10161H9::DQCGGround1 Power1 Ground1 Power1 D14 c==> Node10161H9::DQCBG Power1 Ground1 Power1 D12 c==> Node10761H12::CQCBGGround1 Power1 Ground1 NC D12 c==> Node10761H12::CQCBGGround1 Power1 Ground1 NC D13 c==> Node107751H3::GQDGGround1 Power1 Ground1 Power1 D3 c==> Node107751H3::GQDGGround1 Power1 Ground1 Power1 D4 c==> Node1012H12::CQCBGFGround1 Power1 Ground1 Power1 D14 c==> Node1012H12::CQCBGFGround1 Power1 NC Power1 D14 c==> Node112H12::CQCBGFGround1 Power1 NC Power1 D16 c==> Node1012H12::CQCBGFGround1 Power1	Dirt C Ground1 NC Ground1 Power1 C GND Dirt <==> Node1013(H8):DQS(Ground1 Power1 Ground1 Power1 DQSGR- Dirt <==> Node1013(H8):DQS(Ground1 Power1 Ground1 Power1 DQSGR- Dirt <==> Node1013(H8):DQS(Ground1 Power1 Ground1 Power1 DQSR Dirt <==> Node1075(H1):DQSG(Ground1 Power1 Ground1 NC GROU Dirt <==> Node1075(H1):DQSG(Ground1 Power1 Ground1 POwer1 DQSR+ Dirt <==> Node10775(H3):GRG(Ground1 Power1 Ground1 POwer1 DQGR Dirt <==> Node104(H1)P::DQSG(Ground1 Power1 Ground1 POwer1 DQGR Dirt <==> Node1012(H1)F:DQGR(Ground1 Power1 NC Power1 DQGR Elk1<<==> Node1012(H1)F:DQGR(Ground1 Power1 NC Power1 VDD Elk2<<===> Node1012(H1)F:DQGR(Ground1 Power1 NC Power1 VDD Elk3<<<==> Node10025HK7::VDDNC	Image Image <t< td=""><td>Dir C Ground1 NC Ground1 Power1 DQSR+ DQS_34_1333 CNNn-Inverting DH6 <=>>Node10161H8::CQSGround1 Power1 Ground1 Power1 DQSR+ DQS_34_1333 ICNNn-Inverting D14 <=>>Node2010111H2:CQSGround1 Power1 Ground1 Power1 VDD Power Non-Inverting D14 <=>>Node2010111H2:CQSGround1 Power1 Ground1 Power1 DQSR+ DQ_34_1333 ICNNn-Inverting D12 <=>>Node10751112:CQSGround1 POwer1 Ground1 NC Ground1 C Ground1 DQSR+ DQ_34_1333<::DQ Non-Inverting</td> D12 <=>>Node107751138::GND Ground1 Power1 Ground1 Power1 DQSR+ DQ_34_1333<::DQ Non-Inverting</t<>	Dir C Ground1 NC Ground1 Power1 DQSR+ DQS_34_1333 CNNn-Inverting DH6 <=>>Node10161H8::CQSGround1 Power1 Ground1 Power1 DQSR+ DQS_34_1333 ICNNn-Inverting D14 <=>>Node2010111H2:CQSGround1 Power1 Ground1 Power1 VDD Power Non-Inverting D14 <=>>Node2010111H2:CQSGround1 Power1 Ground1 Power1 DQSR+ DQ_34_1333 ICNNn-Inverting D12 <=>>Node10751112:CQSGround1 POwer1 Ground1 NC Ground1 C Ground1 DQSR+ DQ_34_1333<::DQ Non-Inverting	$ \begin{array}{c c c c c c c c c c c c c c c c c c c $

- 7. Select signals **DQ0R~DQ7R**, **DQS0R+**, and **DQS0R-**.
- 8. Select DQ_34_1333::DQ in the column of Model.

Pulldown	Pullup				Manufal.	Delevitor	China da se	En al-la	Cons Marca	
		GND Clamp	Power Clamp	▲ Signal name△	Model	Polarity	Stimulus	Enable	Sgn Mon	P
	Power1	Ground1	Power1	DQOR	DQ_34_1333 :: DQ	Non-Inverting				_
	Power1	Ground1	Power1	DQ1R	DQ_34_1333 :: DQ	Non-Inverting				
	Power1	Ground1	Power1	DQ2R	DQ_34_1333 :: DQ	Non-Inverting				
	Power1	Ground1	Power1	DQ3R	DQ_34_1333 :: DQ	Non-Inverting				
	Power1	Ground1	Power1	DQ4R	DQ_34_1333 :: DQ	Non-Inverting				
	Power1	Ground1	Power1	DQ5R	DQ_34_1333 :: DQ	Non-Inverting				
	Power1	Ground1	Power1	DQ6R	DQ_34_1333 :: DQ	Non-Inverting				
	ower1	Ground1	Power1	DQ7R	DQ_34_1333 :: DQ	Non-Inverting				
	Power1	Ground1	Power1	DQS0R+	DQ_34_1333 :: DQ	Non-Inverting				
	ower1	Ground1	Power1	DQS0R-	DQ_34_1333 :: DQ	Non-Inverting				
	IC .	Ground1	NC	GND	Gnd	Non-Inverting				
	IC	Ground1	NC	GND	Gnd	Non-Inverting				
	NC .	Ground1	NC	GND	Gnd	Non-Inverting				
	IC .	Ground1	NC	GND	Gnd	Non-Inverting				
undi N	NC .	Ground1	NC	GND	Gnd	Non-Inverting				
und1 N	IC .	Ground1	NC	GND	Gnd	Non-Inverting				
und1 N	NC .	Ground1	NC	GND	Gnd	Non-Invertina				
und1 N und1 N	NC NC	Ground1 Ground1		NC NC	NC GND NC GND	NC GND Gnd NC GND Gnd	NC GND Gnd Non-Inverting NC GND Gnd Non-Inverting NC GND Gnd Non-Inverting	NC GND Gnd Non-Inverting NC GND Gnd Non-Inverting NC GND Gnd Non-Inverting	NC GND Gnd Non-Inverting NC GND Gnd Non-Inverting NC GND Gnd Non-Inverting	NC GND Gnd Non-Inverting NC GND Gnd Non-Inverting NC GND Gnd Non-Inverting

9. Select **Input** in the column of **Enable**.

Pulldown	Pullup	GND Clamp	Power Clamp	🔺 Signal name 🗠	Model	Polarity	Stimulus	Enable	Sgn Mon	Pwr Mon
ound1	Power1	Ground1	Power1	DQOR	DQ_34_1333 :: DQ	Non-Inverting		Input		
und1	Power1	Ground1	Power1	DQ1R	DQ_34_1333 :: DQ	Non-Inverting		Input		
undi	Power1	Ground1	Power1	DQ2R	DQ_34_1333 :: DQ	Non-Inverting		Input		
undi	Power1	Ground1	Power1	DQ3R	DQ_34_1333 :: DQ	Non-Inverting		Input		
undi	Power1	Ground1	Power1	DQ4R	DQ_34_1333 :: DQ	Non-Inverting		Input		
und1	Power1	Ground1	Power1	DQ5R	DQ_34_1333 :: DQ	Non-Inverting		Input		
undi	Power1	Ground1	Power1	DQ6R	DQ_34_1333 :: DQ	Non-Inverting		Input		
undi	Power1	Ground1	Power1	DQ7R	DQ_34_1333 :: DQ	Non-Inverting		Input		
undi	Power1	Ground1	Power1	DQS0R+	DQ5_34_1333 :: D	Non-Inverting		Input		
und1	Power1	Ground1	Power1	DQS0R-	DQ5_34_1333 :: D	Non-Inverting		Input		
undi	NC	Ground1	NC	GND	Gnd	Non-Inverting				
undi	NC	Ground1	NC	GND	Gnd	Non-Inverting				
undi	NC	Ground1	NC	GND	Gnd	Non-Inverting				
undi	NC	Ground1	NC	GND	Gnd	Non-Inverting				
undi	NC	Ground1	NC	GND	Gnd	Non-Inverting				
undi	NC	Ground1	NC	GND	Gnd	Non-Inverting				
undi	NC	Ground1	NC	GND	Gnd	Non-Invertina				
ound1	NC	Ground1	NC	GND	Gnd	Non-Invertina				

10. Check **Pwr Mon**.

Pullup GND Clamp Power Clamp Signal name 4 Model / Polarity Stimulus Enable Sign Mon Pww Mon Power1 Ground1 Power1 DQ0R DQ.34_1333 :: DQ Non-Inverting Input	S\d	fram.ibs							Component :	dram	
Power1 Ground1 Power1 DQ1R DQ_3H_1333 :: DQ Non-Inverting Input Imput Imput <t< th=""><th>1</th><th>Pullup</th><th>GND Clamp</th><th>Power Clamp</th><th>Signal name</th><th>🔺 Model</th><th>A Polarity</th><th>Stimulus</th><th>Enable</th><th>Sgn Mon</th><th>Pwr Mon</th></t<>	1	Pullup	GND Clamp	Power Clamp	Signal name	🔺 Model	A Polarity	Stimulus	Enable	Sgn Mon	Pwr Mon
Power1 Ground1 Power1 DQ2R DQ.34_1333 :: DQ Non-Inverting Input Imput Imput <t< td=""><td></td><td>Power1</td><td>Ground1</td><td>Power1</td><td>DQOR</td><td>DQ_34_1333 :: DQ</td><td>Non-Inverting</td><td></td><td>Input</td><td></td><td></td></t<>		Power1	Ground1	Power1	DQOR	DQ_34_1333 :: DQ	Non-Inverting		Input		
Power1 Ground1 Power1 DQ3R DQ34_1333 :: DQ Non-Inverting Input Imput Imput <td< td=""><td></td><td>Power1</td><td>Ground1</td><td>Power1</td><td>DQ1R</td><td>DQ_34_1333 :: DQ</td><td>Non-Inverting</td><td></td><td>Input</td><td></td><td>\checkmark</td></td<>		Power1	Ground1	Power1	DQ1R	DQ_34_1333 :: DQ	Non-Inverting		Input		\checkmark
NC Ground1 NC GND Gnd Non-Inverting		Power1	Ground1	Power1	DQ2R	DQ_34_1333 :: DQ	Non-Inverting		Input		\checkmark
NC Ground1 NC GND Gnd Non-Inverting		Power1	Ground1	Power1	DQ3R	DQ_34_1333 :: DQ	Non-Inverting		Input		\checkmark
NC Ground1 NC GND Gnd Non-Inverting		Power1	Ground1	Power1	DQ4R	DQ_34_1333 :: DQ	Non-Inverting		Input		\checkmark
NC Ground1 NC GND Gnd Non-Inverting		Power1	Ground1	Power1	DQ5R	DQ_34_1333 :: DQ	Non-Inverting		Input		\checkmark
NC Ground1 NC GND Gnd Non-Inverting		Power1	Ground1	Power1	DQ6R	DQ_34_1333 :: DQ	Non-Inverting		Input		\checkmark
NC Ground1 NC GND Gnd Non-Inverting		Power1	Ground1	Power1	DQ7R	DQ_34_1333 :: DQ	Non-Inverting		Input		\checkmark
NC Ground1 NC GND Gnd Non-Inverting		Power1	Ground1	Power1	DQS0R+	DQ_34_1333 :: DQ	Non-Inverting		Input		\checkmark
NC Ground1 NC GND Gnd Non-Inverting		Power1	Ground1	Power1	DQS0R-	DQ_34_1333 :: DQ	Non-Inverting		Input		\checkmark
NC Ground1 NC GND Gnd Non-Inverting		NC	Ground1	NC	GND	Gnd	Non-Inverting				
NC Ground1 NC GND Gnd Non-Inverting		NC	Ground1	NC	GND	Gnd	Non-Inverting				
NC Ground1 NC GND Gnd Non-Inverting NC Ground1 NC GND Gnd Non-Inverting NC Ground1 NC GND Gnd Non-Inverting		NC	Ground1	NC	GND	Gnd	Non-Inverting				
NC Groundt NC GND Gnd Non-Inverting NC Groundt NC <u>GND Gnd Non-Inverting</u>		NC	Ground1	NC	GND	Gnd	Non-Inverting				
NC Ground1 NC GND Gnd Non-Inverting		NC	Ground1	NC	GND	Gnd	Non-Inverting				
		NC	Ground1	NC	GND	Gnd	Non-Inverting				
		NC	Ground1	NC	GND	Gnd					
	1						10				

9 <==> Node3144 8 <==> Node2706 7 <==> Node2371 1 <==> Node2070 9 <==> Node1642	IIK8::DQ1FGr IL7::DQ2RGr	round1 round1	Power1 Power1 Power1	Ground1 Ground1	Power1 Power1		DQ_34_1333 :: DO DQ_34_1333 :: DO			1
7 <==> Node2371 1 <==> Node2070	IL7::DQ2RGr	round1			Power1	DQ1R	DO 34 1333 :: DO	Non-Inverting		
1 <==> Node2070			Power1							
	U1::DQ3R Gr		FOWOIT	Ground1	Power1	DQ2R	DQ_34_1333 :: DO	Non-Inverting		
9 <==> Node1642			Power1		Power1		DQ_34_1333 :: DO			
			Power1	Ground1	Power1		DQ_34_1333 :: DO			
3 <==> Node1299			Power1		Power1		DQ_34_1333 :: DO	Non-Inverting		
2 <==> Node1172	IK2::DQ6FGr	ound1	Power1	Ground1	Power1	DQ6R	DQ_34_1333 :: DO	Non-Inverting		
			Power1	Ground1	Power1	DQ7R	DQ_34_1333 :: DO	Non-Inverting		
			Power1	Ground1	Power1	DQS0R+	DQS_34_1333 :: D	CNon-Inverting		
			Power1	Ground1	Power1	DQS0R-	DQ5_34_1333 :: D	CNon-Inverting		
3 <==> Node1076	3!!H3::GNEGr	ound1	NC	Ground1	NC	GND	Gnd	Non-Inverting		
			NC				Gnd	Non-Inverting		
3 <==> Node1074	9!!M3::GNIGr	ound1	NC	Ground1	NC	GND	Gnd	Non-Inverting		
						GND	Gnd	Non-Inverting		
9 <==> Node1094	211T9::GND Gr	ound1	NC	Ground1	NC	GND	Gnd	Non-Inverting		
8 <==> Node1076	5!!L8::GND Gr	ound1	NC	Ground1	NC	GND	Gnd	Non-Inverting		
2 <==> Node1076	.!!J2::GND Gr	ound1	NC	Ground1	NC	GND	Gnd	Non-Invertina		
	1 <==> Node1151! 7 <==> Node1044! 8 <==> Node10161 3 <==> Node1076: 3 <==> Node10776 8 <==> Node10775 9 <==> Node10742 8 <==> Node10742 8 <==> Node10742	1 <=> Node1151!L1::DQ7R G 7 <=> Node104!117::QQ50 G 8 <=> Node1074!117::QQ50 G 13 <=> Node10778!117::GNG7 7 <=> Node10778!117::GNG7 8 <=> Node10779!113::GNG 9 <=> Node10779!I13::GNG 9 <=> Node10756!I12::GNCG 8 <=> Node10766!I12::GNCG 8 <=> Node10766!I12::GNCG	1 <=>> Node115111L1::DQ7RGround1 7 <=>> Node10441137:DQ50Ground1 8 <=>> Node107631H3::QQ50Ground1 7 <=>> Node107631H3::GNIGround1 7 <=>> Node1077491H3::GNIGround1 8 <=>> Node1077491H3::GNIGround1 8 <=>> Node1077491H3::GNIGround1 9 <=>> Node107491H3::GNIGround1 9 <=>> Node1076411B3::GNIGround1	1 <=>> Node1151!!L1::DQ7RGround1 Power1 7 <=>> Node1044!137::DQ50.Ground1 Power1 8 <==>> Node10763!!H3::DQ5(Ground1 Power1 8 <==>> Node10763!!H3::GNGround1 NC 7 <==> Node107763!!H3::GNGround1 NC 8 <==>> Node10775!!H3::GNGround1 NC 9 <==> Node10775!!J3::GNGround1 NC 8 <==>> Node10775!!J3::GNGround1 NC 8 <==>> Node10776!!J3::GNGround1 NC 8 <==>> Node10776!!J3::GNGround1 NC 8 <==>> Node10776!!J3::GNGround1 NC 8 <==>> Node1076!!J3::GNGround1 NC 2 <==>> Node1076!!J3::GNDGround1 NC	1 <==> Node1151!!!::DQ7RGround1 Power1 Ground1 7 <==> Node104!!17::DQ50 Ground1 Power1 Ground1 8 <==> Node1016!H8::DQ5(Ground1 NC Ground1 13 <==> Node10769!H3::GMCGround1 NC Ground1 7 <==> Node10776!H3::GMCGround1 NC Ground1 8 <==> Node10776!H3::GMCGround1 NC Ground1 8 <==> Node1075!H3::GMCGround1 NC Ground1 9 <==> Node1075!H3::GMCGround1 NC Ground1 9 <==> Node1075!H3::GMCGround1 NC Ground1 9 <==> Node1075!H3::GMCGround1 NC Ground1	1 <==> Node1151!!L1::DQ7R.Ground1 Power1 Ground1 Power1 7 <==> Node104!!17::DQ50.Ground1 Power1 Ground1 Power1 8 <==> Node1078:!H7::QS0.Ground1 Power1 Ground1 Power1 9 <==> Node1078:!H7::GNCGround1 NC Ground1 NC 7 <==> Node1078:!H7::GNCGround1 NC Ground1 NC 7 <==> Node10778:!H7::GNCGround1 NC Ground1 NC 8 <==> Node10778:!H7::GNCGround1 NC Ground1 NC 9 <==> Node10778:!H7::GNCGround1 NC Ground1 NC 8 <==> Node10775!!H7::GNCGround1 NC Ground1 NC 8 <==> Node1076!!L1::GNCGround1 NC Ground1 NC 8 <==> Node1076!!L1::GNCGround1 NC Ground1 NC 2 <==> Node1076!!L1::GNCGround1 NC Ground1 NC	1 <=>> Node1151!!L1::DQ7R Ground1 Power1 Ground1 Power1 DQ7R 7 <=>> Node1044!177::DQ50 Ground1 Power1 Ground1 Power1 DQ50R+ 8 <==> Node10761!H3::DQ50Ground1 Power1 Ground1 Power1 DQ50R+ 3 <==> Node10763!H3::GNGround1 NC Ground1 NC GND 7 <==> Node107761!H7::GNGround1 NC Ground1 NC GND 3 <==> Node107751!H3::GNGround1 NC Ground1 NC GND 3 <==> Node107751!H3::GNDGround1 NC Ground1 NC GND 8 <==> Node10775!!H3::GNDGround1 NC Ground1 NC GND 9 <==> Node10776!!H3::GNDGround1 NC Ground1 NC GND 8 <==> Node10776!!H3::GNDGround1 NC Ground1 NC GND 8 <==> Node10776!!H3::GNDGround1 NC Ground1 NC GND 8 <==> Node10776!!H3::GNDGround1 NC Ground1 NC GND	1 <==> Node1151!!L1::DQ7R Ground1 Power1 Ground1 Power1 DQ7R DQ_34_1333 :: DQ 7 <==> Node104!!17::DQ30 Ground1 Power1 Ground1 Power1 DQ50R+ DQ5_34_1333 :: DQ 8 <==> Node10763!!H3::GQGGround1 Power1 Ground1 Power1 DQ50R+ DQ5_34_1333 :: DQ 3 <==> Node10763!!H3::GQGround1 PC Ground1 NC GRUD Gnd 13 <==> Node10778!!H3::GQGround1 NC Ground1 NC GRUD Gnd 3 <==> Node10778!!H3::GQGround1 NC Ground1 NC GRUD Gnd 3 <==> Node10778!!H3::GNG oround1 NC Ground1 NC GND Gnd 8 <==> Node10778!!H3::GNG oround1 NC Ground1 NC GND Gnd 8 <==> Node10778!!H3::GNG oround1 NC Ground1 NC GND Gnd 8 <==> Node1076!!L3::GNG oround1 NC Ground1 NC GND Gnd 8 <==> Node1076!!L3::GNG oround1 NC Ground1 NC GND Gnd 2 <==> Nod	1 <==> Node1151!!!::DQ7RGround1 Power1 Ground1 Power1 DQ7R DQ34_1333::DQ Non-Inverting 7 <==> Node1044117::DQ30 Ground1 Power1 Ground1 Power1 DQ50R+ DQ5_34_1333::DQ DQ1n-Inverting 8 <==> Node101611H8::DQ50Ground1 Power1 Ground1 Power1 DQ50R+ DQ5_34_1333::DCNon-Inverting 3 <==> Node107581H3::GNGround1 NC Ground1 NC GND Gnd Non-Inverting 13 <==> Node107781H3::GNGround1 NC Ground1 NC GND Gnd Non-Inverting 13 <==> Node107781H3::GNGround1 NC Ground1 NC GND Gnd Non-Inverting 3 <==> Node107781H3::GNGround1 NC Ground1 NC GND Gnd Non-Inverting 9 <==> Node107781H3::GNG-Ground1 NC Ground1 NC GND Gnd Non-Inverting 9 <==> Node10761H2::GNG-Ground1 NC Ground1 NC GND Gnd Non-Inverting 8 <==> Node10761H2::GNG-Ground1 NC Ground1 NC GND <td>1 <==> Node1151!!L1::DQ7R Ground1 Power1 Ground1 Power1 DQ7R DQ_34_1333 :: DQ Non-Inverting 7 <==> Node104!!17::DQ30 Ground1 Power1 Ground1 Power1 DQ5R+ DQ5_34_1333 :: DC Non-Inverting 8 <==> Node10763!!H3::GNGround1 Power1 Ground1 Power1 DQ5R+ DQ5_34_1333 :: DC Non-Inverting 3 <==> Node10763!!H3::GNGround1 NC Ground1 NC GND Gnd Non-Inverting 3 <==> Node10778!!H3::GNGround1 NC Ground1 NC GND Gnd Non-Inverting 3 <==> Node10778!!H3::GNGround1 NC Ground1 NC GND Gnd Non-Inverting 3 <==> Node10778!!H3::GNG Ground1 NC Ground1 NC GND Gnd Non-Inverting 3 <==> Node10778!!H3::GNG Ground1 NC Ground1 NC GND Gnd Non-Inverting 9 <==> Node107978!!H3::GNG Ground1 NC Ground1 NC GND Gnd Non-Inverting 8 <==> Node10775!!!H3::GNG Ground1 NC Ground1 NC GND Gn</td>	1 <==> Node1151!!L1::DQ7R Ground1 Power1 Ground1 Power1 DQ7R DQ_34_1333 :: DQ Non-Inverting 7 <==> Node104!!17::DQ30 Ground1 Power1 Ground1 Power1 DQ5R+ DQ5_34_1333 :: DC Non-Inverting 8 <==> Node10763!!H3::GNGround1 Power1 Ground1 Power1 DQ5R+ DQ5_34_1333 :: DC Non-Inverting 3 <==> Node10763!!H3::GNGround1 NC Ground1 NC GND Gnd Non-Inverting 3 <==> Node10778!!H3::GNGround1 NC Ground1 NC GND Gnd Non-Inverting 3 <==> Node10778!!H3::GNGround1 NC Ground1 NC GND Gnd Non-Inverting 3 <==> Node10778!!H3::GNG Ground1 NC Ground1 NC GND Gnd Non-Inverting 3 <==> Node10778!!H3::GNG Ground1 NC Ground1 NC GND Gnd Non-Inverting 9 <==> Node107978!!H3::GNG Ground1 NC Ground1 NC GND Gnd Non-Inverting 8 <==> Node10775!!!H3::GNG Ground1 NC Ground1 NC GND Gn

After all the settings, the green signs appear ahead of the selected signals.

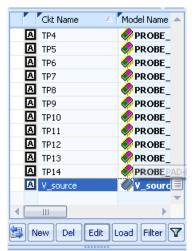
- 11. Click **OK**.
- Repeat Step 2 to 11 to define the file dram.ibs for D8 and set parameters as the following: Model: DQ_34_ODT60_1333

Enable: Input

Pulldown	Pullup	GND Clamp	Power Clamp	Signal name	Model	Polarity	Sti	🔺 Enable	🛆 🛛 Sgn Mon 👘	Pwr Mon
ound1	Power1	Ground1	Power1	DQ0R	DQ_34_0DT60_1333 :: DQ	Non-Inverting		Input		
ound1	Power1	Ground1	Power1	DQ1R	DQ_34_ODT60_1333 :: DQ	Non-Inverting		Input		
ound1	Power1	Ground1	Power1	DQ2R	DQ_34_ODT60_1333 :: DQ	Non-Inverting		Input		
ound1	Power1	Ground1	Power1	DQ3R	DQ_34_0DT60_1333 :: DQ	Non-Inverting		Input		
ound1	Power1	Ground1	Power1	DQ4R	DQ_34_ODT60_1333 :: DQ	Non-Inverting		Input		
ound1	Power1	Ground1	Power1	DQ5R	DQ_34_ODT60_1333 :: DQ	Non-Inverting		Input		
ound1	Power1	Ground1	Power1	DQ6R	DQ_34_ODT60_1333 :: DQ	Non-Inverting		Input		
ound1	Power1	Ground1	Power1	DQ7R	DQ_34_0DT60_1333 :: DQ	Non-Inverting		Input		
ound1	Power1	Ground1	Power1	DQS0R+	DQ_34_ODT60_1333 :: DQ	Non-Inverting		Input		
ound1	Power1	Ground1	Power1	DQS0R-	DQ_34_0DT60_1333 :: DQ	Non-Inverting		Input		
ound1	NC	Ground1	NC	GND	Gnd	Non-Inverting				
ound1	NC	Ground1	NC	GND	Gnd	Non-Inverting				
ound1	NC	Ground1	NC	GND	Gnd	Non-Inverting				
ound1	NC	Ground1	NC	GND	Gnd	Non-Inverting				
ound1	NC	Ground1	NC	GND	Gnd	Non-Inverting				
ound1	NC	Ground1	NC	GND	Gnd	Non-Inverting				
ound1	NC	Ground1	NC	GND	Gnd	Non-Invertina				

3.3.3 Setting Up VRM

- 1. Choose Setup > Circuit/Linkage Manager....
- 2. Select V _source.



3. Click the **Edit** button.

The **Edit Definition** window opens.

4. Input the definition as below.

Name: V_source External Nodes: 1 2

Definition: Vdd 2 1 1.5

Definition Type				
 Partial Circuit 	O Sub-circuit	O Model	 SpeedXP 	OHSPICE
me : V_source			Local Parameters :	Global Parameter
			Name Value	
ternal Nodes : 1 2				
finition :			Model File	Edit Delete
ld 2 1 1.5			Type:	
			File Name :	
			Component Name:	
			Edit IBIS	Delete IBIS
			Header/Footer Info :	Read-Onl
			+ ExtNode = 1 2	
			****	*Footer********

5. Click OK.

V_Source is added as shown below.

5 <u>8</u> .2	て.豪し	7.6	
	•••• !		
		uric é (()))	

3.4 Generating Mesh

This section describes how to set the mesh for the FDTD plane solver process. The mesh can be auto-generated following the instructions below.

1. Click Generate Mesh in the Workflow pane.

The Mesh window opens.

Mesh			×
Г	Change to	Default	
Mesh_X	84	60	
Mesh_Y	37	60	
[Automatically G	enerate Mesh	
Package Nar	ne: \$Package		
	ОК	Cancel	

- 2. Click the Automatically Generate Mesh button.
- 3. Click **OK**.

3.5 Assigning Simulation Time

This section describes how to set the simulation time to the desired span.

1. Click Assign Simulation Time in the Workflow pane.

The Transient window opens.

Transient Time:	10		×
rime:	10	ns 🔻	
Timesteps:	2758	Time_Interval: 1	0
🗌 Enable id	eal power-grour	nd mode	
Time step:	3,6256	ps	
Enable plane skin effect			
Enable transmission line metal loss			
🗹 Enable di	electric loss and	dispersion	
Enable initial DC analysis			
	[OK Can	el

- 2. Input simulation time: **10ns**.
- 3. Check Enable plane skin effect, Enable transimission line metal loss, and Enable dielectric loss and dispersion.

Enable initial DC analysis is automatically checked.

4. Click **OK**.

3.6 Radiation

This section describes how to use SPEED2000 to save the data needed to do radiation postprocessing. SPEED2000 allows you to do wideband radiation post-processing. However, for most practical purposes, it is only optional to generate radiation results up to a few GHz. It is necessary to set a max frequency in order to reduce the storage space needed for the post-processing.

1. Click **Radiation** in the **Workflow** pane.

The SPEED GENERATOR dialog box opens.

SPEED GE	INERATOR
?	Would you like to set the maximum frequency for radiation calculation? Note: Setting the maximum frequency for radiation calculation can help to reduce the size of radiation data file. Default it is 3GHz.
	Yes No

2. Click Yes.

The **Options > Simulation (Basic) > Radiation** window opens.

Options	;
File (*) General File Manager Save Options Hotkeys	Change the 'Radiation' options in SPEED GENERATOR
Layout Grid and Unit View Processing Trace Error Checking 3D Layout View	If you want to observe the near field or far field radiation, select Setup->Simulation View->Radiation in the menu so that the simulation results will be saved for the radiating structures.
Display Quality Simulation (Basic) (*) General Special Void Radiation Report	✓ The maximum frequency for radiation calculation 3.000000 GHz
Simulation (Advanced) Electric Models Field Solver Reference Handling Shape Options Device Model Temperature External Solver Special Handling	Note: Setting the maximum frequency for radiation calculation can help to reduce the size of radiation data file.
	Default Apply OK Cancel

3. Change the maximum frequency for radiation calculation from **3**GHz to **8**GHz.

File	$\overline{\mathbf{O}}$	
General File Manager		Change the 'Radiation' options in SPEED GENERATOR
Save Options Hotkeys		
Grid and Unit View Processing Trace Error Checking	<u></u>	If you want to observe the near field or far field radiation, select Setup->Simulation View->Radiation in the menu so that the simulation results will be saved for the radiating structures.
3D Layout View		
Display Quality		
Simulation (Basic) General Special Void Radiation Report	<u> </u>	✓ The maximum frequency for radiation calculation 3
Simulation (Advanced Electric Models Field Solver Reference Handling Shape Options Device Model Temperature External Solver Special Handling	<u>)</u>	Note: Setting the maximum frequency for radiation calculation can help to reduce the size of radiation data file.

4. Click **OK**.

3.7 Checking Monitor Component Voltage

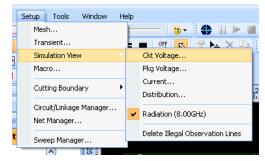
In the monitor component voltage, you can set monitor points to control the voltages that you want to measure.

You can only add probes on components that are enabled. So if you want to probe at unplaced device pins, you need to add the device model or place a large resistance across the probe points. The probe points can be used to check the conducted emissions.

1. Click Monitor Component Voltage in the Workflow pane,

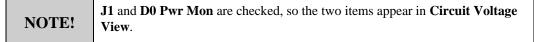
or

Choose Setup > Simulation View > Ckt Voltage....



The Circuit Voltage View window opens.

Circuits/Sub Circuits	Circuit Node/SubCkt Node	e Curve_Color:
$\begin{array}{c} \hline		green Curve_Name: Curve_Name: ✓ Show Enabled Circuit Left mouse click Right mouse click O In circuit tree In node list Find
*.#.#<====>#.#.#		Auto
	m.Power1<====>DO.X_SpeedXP_auto_DRAM_D Power1<====>J1.X_SpeedXP_auto_CTRL_DDR3	
		Update
		Delete
		ОК



- 2. Add simulation view for **J1**.
 - a. Click J1 in the Circuits/Sub Circuits column.

b. Click the **Auto** button.

Circuits/Sub Circuits		Circuit Node/SubCkt Node		Curve_Color:
	_	1 ::VREF		darkred
🗄 🧑 C80		2 ::GND		Curve_Name:
😠 🤣 C81		3 ::GND		
🛓 🤣 C83		4 ::DQ4		
🗄 🧖 C84		5 ::DQ0		Show Enabled Circuit:
🗄 🦿 🆉 C86		6 ::DQ5		—
E C89		7 ::DQ1		🕀 Left mouse click
i∃ - 🤣 C91 i∃ - 🤣 D0		8 ::GND		😑 Right mouse click
± Ø D8		9 ::GND		
		10 ::DM0		Quick Find
🗄 🧼 RA1		11 ::DQ50-		 In circuit tree
🗄 🧼 RA2		12 ::GND		O In node list
🗄 🥔 RA18	=	13 ::DQ50+		
🗄 🤣 RA20		14 ::DQ6		Find
⊞ 🤣 V_source		15 ::GND	-	
.#.#<====>J1.#.#				Auto
00.X_SpeedXP_auto_DRAM_D0_dram.Powe 11.X_SpeedXP_auto_CTRL_DDR3_i.Power1<				Add
				Update
				Delete
				ок

The J1 circuit node is added automatically as below.

Circuit Voltage View			×
Circuits/Sub Circuits	Circuit Node/SubCkt Node		Curve_Color:
	1 ::VREF 2 ::GND 3 ::GND 4 ::DQ4 5 ::DQ0 6 ::DQ5 7 ::DQ1 8 ::GND 9 ::GND 10 ::DM0 11 ::DQS0- 12 ::GND 13 ::DQ50+ 14 ::DQ6 15 ::GND		green ▼ Curve_Name: ✓ <t< td=""></t<>
J1.#.#<====>J1.#.#			Auto
D0.X_SpeedXP_auto_DRAM_D0_dram.Power1<====>D0. J1.11.#::DQS0-<====>J1.12.#::GND J1.13.#::DQS0+<====>J1.142.#::GND J1.16.#::DQ6<====>J1.144.#::GND J1.16.#::DQ7<====>J1.161.#::GND J1.17.#::DQ2<====>J1.190.#::GND J1.4.#::DQ3<====>J1.40.#::GND J1.5.#::DQ0<====>J1.60.#::GND J1.6.#::DQ5<====>J1.60.#::GND	X_SpeedXP_auto_DRAM_D0_di	ram.Grov	Add Update Delete OK
		•	Cancel

- 3. Add simulation view for **D0**.
 - a. Click **D0** in the **Circuits/Sub Circuits** column.

b. Click the **Auto** button.

Circuit Voltage View				×
Circuit Voltage View		Circuit Node/SubCkt Node H1 ::VDD H2 ::Unnamed Net(s) H3 ::GND H7 ::GND H8 ::DQSOR- H9 ::VDD J1 ::DQ3R J2 ::GND J3 ::DM0R J7 ::DQSOR+ J8 ::GND J9 ::DQOR K1 ::VDD		× Curve_Color: darkred Curve_Name: Show Enabled Circuits Left mouse click Right mouse click Quick Find In circuit tree In node list
RA2 RA3 D0.#.# RA18 D1.16.#::DQ7 D1.16.#::Q7 RA18 D1.15.#::DQ7 D1.15.#::Q7 RA18 D1.15.#::DQ2 D1.15.#::GND J1.44.#::GND J1.5.#::DQ3 D1.4.#::GND J1.5.#::DQ4 D1.5.#::DQ3 D1.6.#::GND J1.5.#::DQ1 See=11.61.#::GND J1.7.#::DQ1 D1.7.#::DQ1 D1.7.#::DQ1 </td <td>.x_s</td> <td>K2 ::DQ6R K3 ::VDD</td> <td>iround</td> <td>Find Auto Add Update Delete OK</td>	.x_s	K2 ::DQ6R K3 ::VDD	iround	Find Auto Add Update Delete OK
ا			•	Cancel

The **D0** circuit node is added automatically as below.

Circuits/Sub Circuits	Circuit Node/SubCkt Node		Curve_Color:	
Image: Cross Constructs Image: Cross Cros Cro	H1 ::VDD H2 ::Unnamed Net(s) H3 ::GND H7 ::GND H8 ::DQ50R- H9 ::VDD J1 ::DQ3R J2 ::GND J3 ::DM0R J7 ::DQ50R+ J8 ::GND J9 ::DQ50R+ K1 ::VDD K2 ::DQ6R K3 ::VDD	•	darkcyan Curve_Name: ✓ Show Enabled Circui ↔ Left mouse click ↔ Right mouse click ✓ Quick Find ↔ In circuit tree ↔ In node list Find	ts
0.#.#<====>D0.#.# D0.13.#::DQ7R<====>D0.12.#::GND D0.13.#::DQSR<====>D0.12.#::GND D0.17.#::DQ2R<====>D0.18.#::GND D0.19.#::DQ4R<====>D0.18.#::GND D0.%_SpeedXP_auto_DRAM_D0_dram.Power1<====>D0.X J1.11.#::DQ50-<====>J1.12.#::GND J1.13.#::DQ50-<====>J1.12.#::GND J1.14.#::DQ50-<====>J1.12.#::GND J1.14.#::DQ50-<====>J1.1161.#::GND J1.16.#::DQ7<====>J1.171.#::GND		am.Gro	Auto Add Update Delete OK	

- 4. (Optional) Follow Step 2 and 3 to add other observations you need.
- 5. Check all the observed nodes and click **OK**.

4 Saving Files and Running Simulation

4.1 Saving File with Error Check

- 1. Click Save File with Error Check in the Workflow pane.
 - The SPEED GENERATOR File Saving Options window opens.

SPEED GENERATOR File Saving 🗙
Shape Processing
Error Checking
Skip Warnings in Error Log File
Delete Illegal Observation Lines
OK Cancel

2. Click OK.

4.2 Running Simulation

1. Click **Start simulation** in the **Workflow** pane.

The Run SPDSIM window opens.

Run SPDSIM	×			
 Load into SPDSIM and simulation Pause 3D displays for maximum efficiency 				
O Load into SPDSIM only				
OK Cancel				

2. Click **OK**.

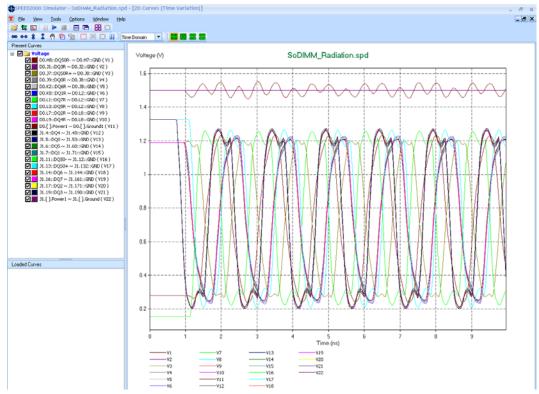
SPEED Simulator starts to simulate. A green bar appears to show the progress of simulation.

Running	
	41%

5 Viewing Results

5.1 Viewing Time Domain Result

After the simulation, the 2D curves show the time domain result.



5.2 Viewing Radiation Result

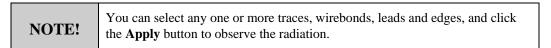
After the simulation, the **Radiation** window appears to show the result.

iation		
p FCC Pattern Near-Field		
ame:		
ane:		
mparison <= Apply Browse		
Trace		
DQ0		
Trace10354::DQ0		
Trace10355::DQ0		
Trace10356::DQ0		
DQOR		
Trace2882::DQ0R		
Trace2883::DQ0R		
Trace2884::DQ0R		
Trace2885::DQ0R		
Trace2886::DQ0R		
Trace2887::DQ0R		
Trace2888::DQ0R		
Trace2889::DQ0R		
Trace2890::DQ0R		
Trace2891::DQ0R		
Trace2892::DQ0R		
Trace2893::DQ0R		
Trace2894::DQ0R		
Trace2895::DQ0R		
Trace2896::DQ0R		
DQ1		
Trace10348::DQ1		
Trace10349::DQ1		
Trace10350::DQ1		
DQ1R		
Trace2485::DQ1R		
Trace2486::DQ1R	•	

- 1. Click the **Setup** tab.
- 2. Select all traces and edges in this tutorial to observe the radiation.

<mark>S</mark> Radiatio			
Setup	FCC Pattern Near-Field		Ē
File Name:			
Compari	ison <= Apply Bi	rowse	
Name			
H 🗹 🛛 1	Trace		
Ξ 🗹 ε	idge		
☑	Patch\$GND1_Patch\$IN1		
	Patch\$IN1_Patch\$IN2		
\checkmark	Patch\$IN2_Patch\$VDD		
	Patch\$VDD_Patch\$IN3		
	Patch\$IN3_Patch\$GND2		
			13

3. Click the **Apply** button to refresh the result including the **FCC**, **Pattern** and **Near-Field** results.

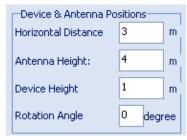


5.2.1 FCC Result

1. Click the FCC tab.

Setup FCC	Patter	n Ne	ar-Field		
fixed observatio	n point	+	-		
Consider arou			lection		
Device & Anter	1.1				
Horizontal Dista	nce	3	m		
Antenna Height	:	4	m		
Device Height		1	m		
Rotation Angle		0 0	legree		
Field Compone	nts				
🗹 E Vertical	_	Horizo	ontal		
In comparison	with V C	acc B			
Custor	m Class				
Signal					
Signal Type : N					
O Log Scale		near S	icale		
Number of Free	·				
Frequency Ran					
From: 20	To:	1000			
Amplitude Ran	ge[dBu	V/m]-			
From: 0	To:	60			
Ir	Interval 0				
Auto Scale					
Properties		Appl	у		
Save Dis	played	Data			

- 2. Define the parameters for **FCC**.
 - a. Define the box size: Antenna Height and Rotation Angle.



b. Define Field Components.



You can

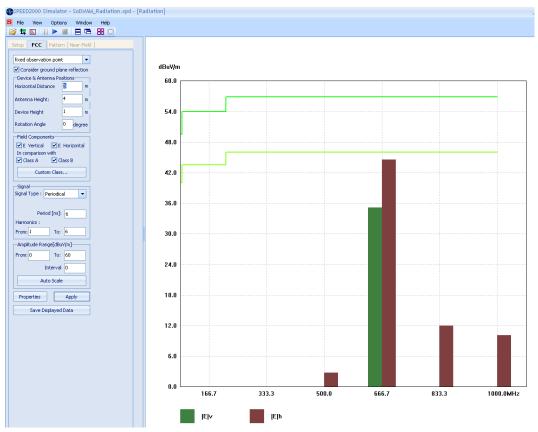
• Select **E Vertical** or **E Horizontal** to view the result

- Define class by clicking the **Custom Class...** button
- c. Define **Signal Type**.

• Signal Type: Periodical
-Signal
Signal Type : Non-Periodical 🔫
Log Scale Non-Periodical Periodical
• Period[ns]: 6
Signal Signal Type : Periodical
Period [ns]: 6
Harmonics :
From: 1 To: 6

3. Click the **Apply** button.

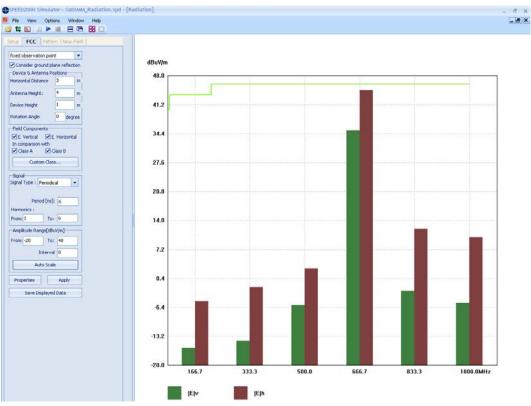
The FCC result shows.



4. Define **Amplitude Range**, or click the **Auto Scale** button to fit the result.

-Amplitude Range[dBuV/m]					
From: 0 To: 60					
In	Interval 0				
Auto Scale					

The result becomes fit as below.



- 5. (Optional) Move the pointer to the FCC to view the data.
- 6. (Optional) Click **Save Displayed Data** to save the displayed data.

5.2.2 Pattern Result

1. Click the **Pattern** tab.

Setup FCC	attern	Near-Fi	eld	
Radius	3			
Radius	9		m	
🗹 Ground plane	1		m	
Field Componen	t			
✓ E_theta	🗹 E	E_phi		
Angle) Fix the	ta degree (0360])	
Signal Signal Type :	Non-P	eriodical	-	
Frequency[MHz]				
Amplitude Range		-		
From: 0	To: 6	0		
In	terval 0			
Auto	Scale			
O Peak Value	ORM	15 Value		
● Phasor Value				
Properties		Apply		
Save Di	splayed (Data		

- 2. Define the parameters for **Pattern**.
 - a. Define the **Radius** value and the distance of **Ground plane**.

Radius	3	m
Ground plane	1	m

NOTE! If you enable the ground plane, there will be a ground plane in the Z-axis.

- b. Define the pattern form.
 - Angle: Fix theta
 - **theta fixed at:** 0 degree

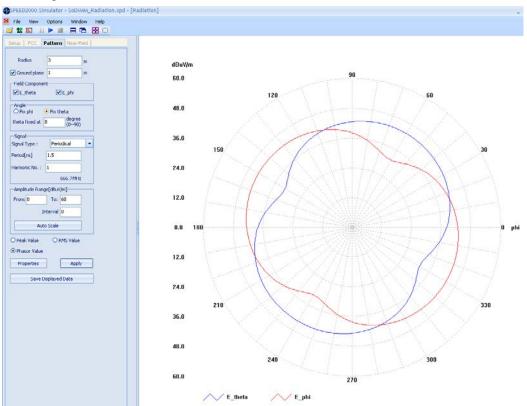
Angle O Fix phi	• Fix the	ta
theta fixed at	0	degree (090)

- c. Define Signal Type.
 - Signal Type: Periodical
 - **Period[ns]:** 1.5

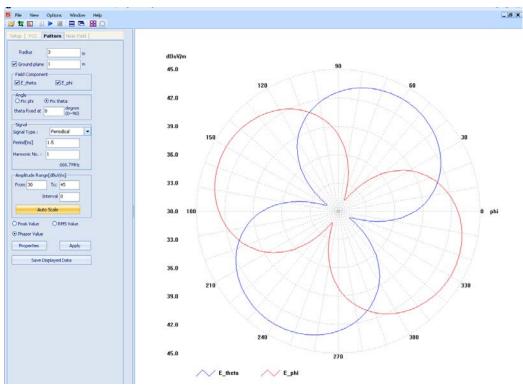
Signal	Signal				
Signal Type :	Periodical 💌				
Period[ns]	1.5				
Harmonic No. :	1				
	666.7MHz				

3. Click the **Apply** button.

The pattern result shows.



4. Define the **Amplitude Range**, or click the **Auto Scale** button to fit the result.



- 5. (Optional) Move the pointer to the pattern to view the data.
- 6. (Optional) Click the **Save Displayed Data** button to save the display data.

5.2.3 Near-Field Result

1. Click the **Near-Field** tab.

Setup FCC	Pattern	Near-Field	
Near-Field-			1
Space X:	3	mm 🔻	
Space Y:	5	mm 🖵	
Space Z:	5	mm 👻	
dX: 0.76	6001mm		
dY: 0.39	0000mm		
dZ: 1.17	7796mm		
Number of S	ampling Poi	ints:	
Nx: 100	Ny:	100	
Nz: 10			
-Calculation-			-
Freque	ncy		
Periodica	al No	n-Periodical	
Calculate		Cancel]

- 2. Define the parameters for **Near-Field**.
 - a. Set the Near-Field space.
 - Space X: 5mm
 - Space Y: 5mm
 - Space Z: 5mm
 - b. Define the number of sampling points.
 - Nx: 100
 - Ny: 100
 - Nz : 10
- 3. Define calculation.
 - a. Click the **Periodical** button.

The Add Frequency Dialog window opens.

Add Frequency Dialog 🛛 🗙					
Signal & Samping	Periodical	-			
	Period[ns]	10			
	Starting harmonic	1			
	Ending harmonic	10			
	Preview	OK Cancel			

- b. Set the following parameters:
 - **Period[ns]:** 1.5
 - Starting harmonic: 1
 - Ending harmonic: 10
- c. Click the **Preview** button.

The frequencies show in the left field.

A	Add Frequency Dialog 🗙 🗙					
	Signal & Samping	Periodical	-			
	666.7 MHz 1.333 GHz 2 GHz					
	2.667 GHz 3.333 GHz	Period[ns]	1.5			
	4 GHz 4.667 GHz 5.333 GHz 6 GHz	Starting harmonic	1			
	6.667 GHz	Ending harmonic	10			
		Preview	OK Cancel			

d. Click OK.

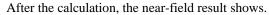
The frequency shows in the **Calculation** column.

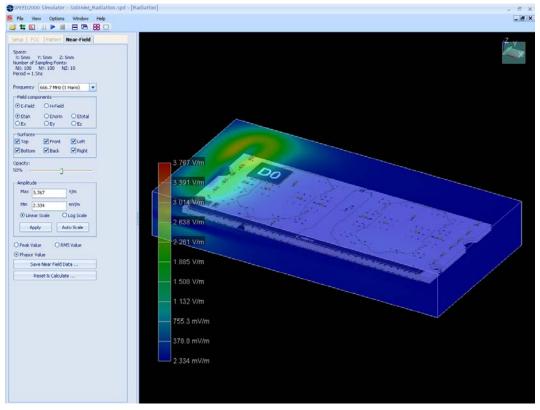
4. Select three frequency points, and click the **Calculate** button.

Calculation (Period =	Harmonic		
Trequency	Harmonic		
🗹 666.7 MHz	1		
🗹 1.333 GHz	2		
🗹 2 GHz	3		
2.667 GHz	4		
📃 3.333 GHz	5	_	
📃 4 GHz	6		
📃 4.667 GHz	7		
📃 5.333 GHz	8	Ξ	
📃 6 GHz	9		
📃 6.667 GHz	10		
		_	
Periodical Non-Periodical			
Calculate Cancel			

A green bar appears showing the progress of calculation.

Calculating
Near-field Transformation 200 MHz
33%
Cancel





5. (Optional) You can change the **Frequency**, **Field components**, **Surfaces** and **Amplitude** to observe the related results.

- 6. (Optional) Move the pointer to the field to view the data.
- 7. (Optional) Click the **Save Near Field Data ...** button to save the data.