

EM Insight Series



Episode #7:

High Speed SATA (Serial ATA)
Connector Modeling with EMPro

Agilent EEsof EDA
November 2008



Agilent Technologies

Application Overview

Typical situation

Faster, smaller, and cheaper... This is what drives the consumer electronics and PC markets. Serial ATA (SATA) interconnects are replacing Parallel ATA (PATA) interfaces for faster data rate, smaller form factor, and probably lower cost design. Due to the faster data transfer rate required in these electronic markets, interconnect design, such as SATA to PCB interface, can no longer be ignored. Designers must include electromagnetic effects (coupling, crosstalk, etc) of SATA connectors with board traces for accurate signal integrity analysis.

Potential users and targeted market

- High Speed Connector manufacturers
- Signal Integrity Engineer (High Speed Board Design along with connector)

EM product used

- [Electromagnetic Professional \(EMPro\)](#)

Design Challenges

Design challenges

Maintaining good signal quality throughout high-density and high-speed interconnects is crucial due to ever increasing demands for quality signal transmission. At multi-gigabit data rates, high speed interconnects must be characterized by s-parameters.

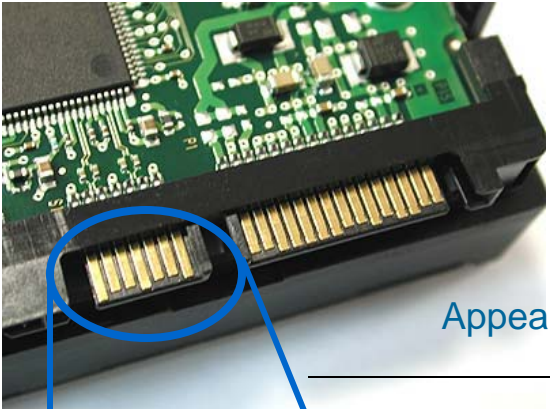
Problem solved

In this episode, a SATA connector is analyzed with EMPro. The SATA connector is simulated along with the board traces to take any discontinuity effects into account. The EMPro simulation file is exported as a design kit into ADS so that the connector data can be re-used for signal integrity analysis along with other circuit components in ADS.

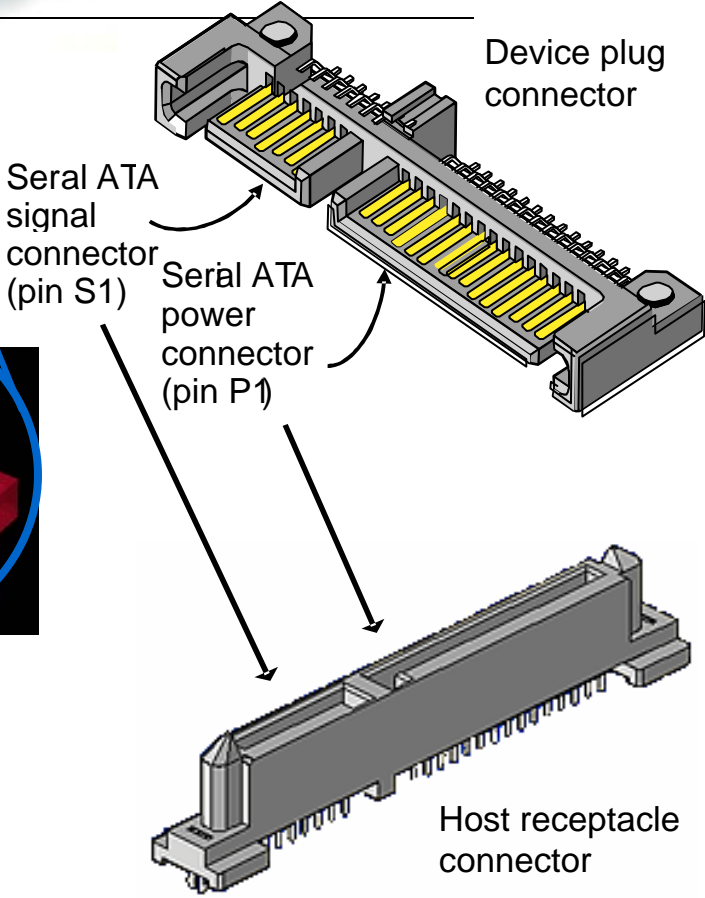
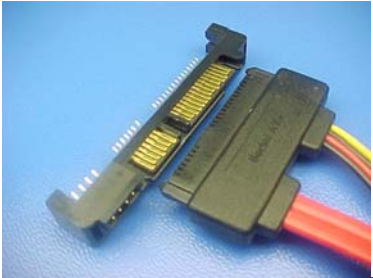
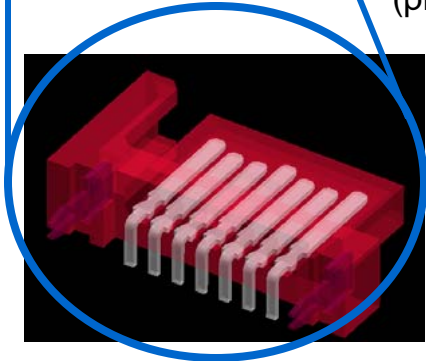
Value delivered

Early insight into possible interconnect design problems enables you to optimize interconnects that produce best possible signal transmission.

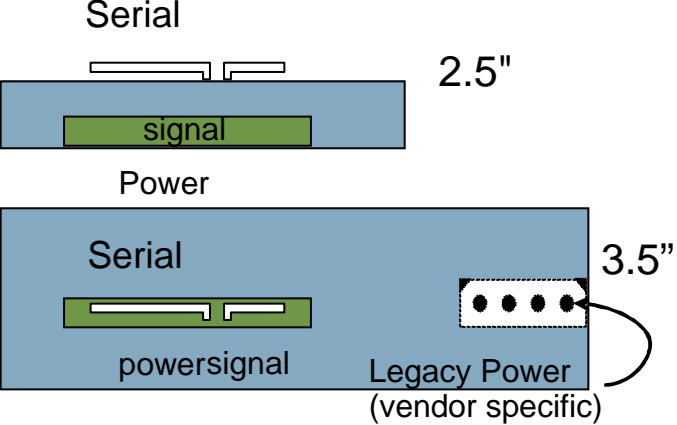
SATA Connector



Appearance of serial ATA connectors

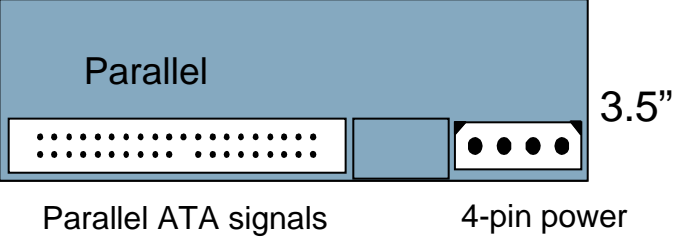


Device connector sizes and locations

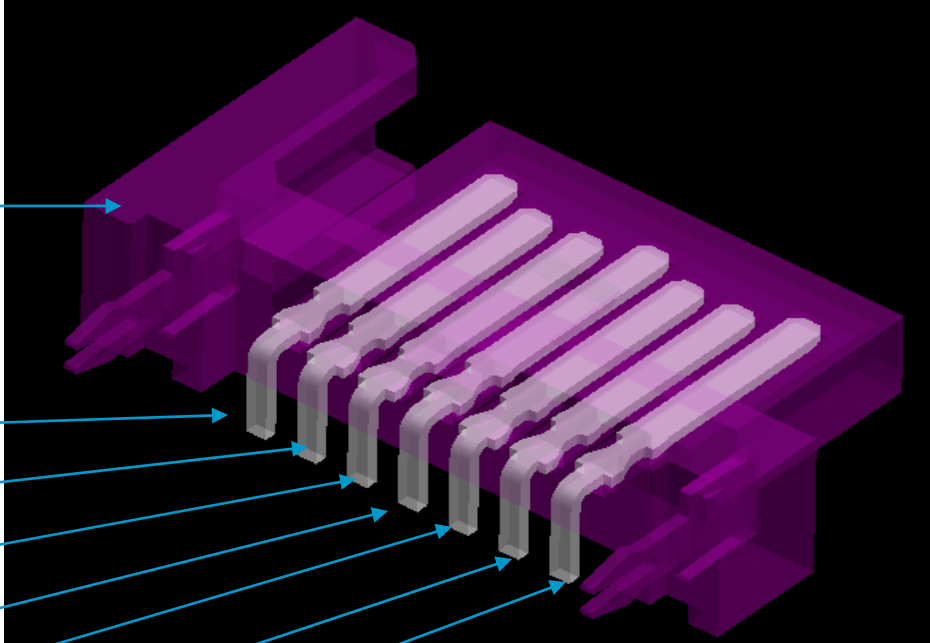


(5.25" form factor also defined for devices like tape drives and DVDs)

in comparison...



SATA Connector Details



Housing material - LCP(Liquid Crystalline Polymer) , Er- 2.9

Ground Pin

Differential Ports (Transmit)

Ground Pin

Differential Ports (Receive)

Ground Pin

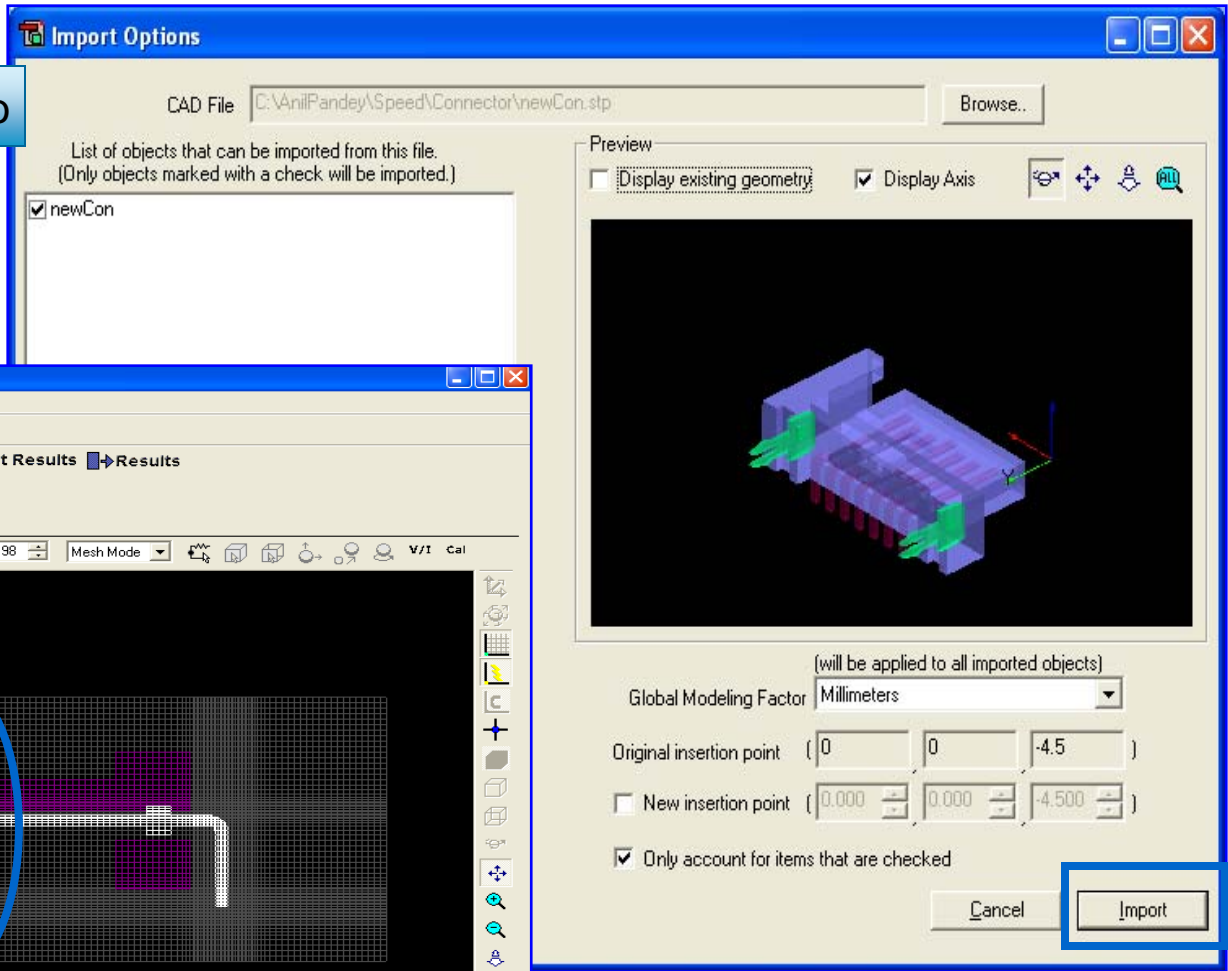
- Pin-1
- Pin-2
- Pin-3
- Pin-4
- Pin-5
- Pin-6
- Pin-7

	One end (mm)			Other end (mm)		
	X	Y	Z	X	Y	Z
Pin-1	3.9	8.2	-4.5	3.9	1.2	-1.9
Pin-2	5.2	8.2	-4.5	5.2	1.2	-1.9
Pin-3	6.5	8.2	-4.5	6.5	1.2	-1.9
Pin-4	7.7	8.2	-4.5	7.7	1.2	-1.9
Pin-5	9.0	8.2	-4.5	9.0	1.2	-1.9
Pin-6	10.3	8.2	-4.5	10.3	1.2	-1.9
Pin-7	11.8	8.2	-4.5	11.8	1.2	-1.9

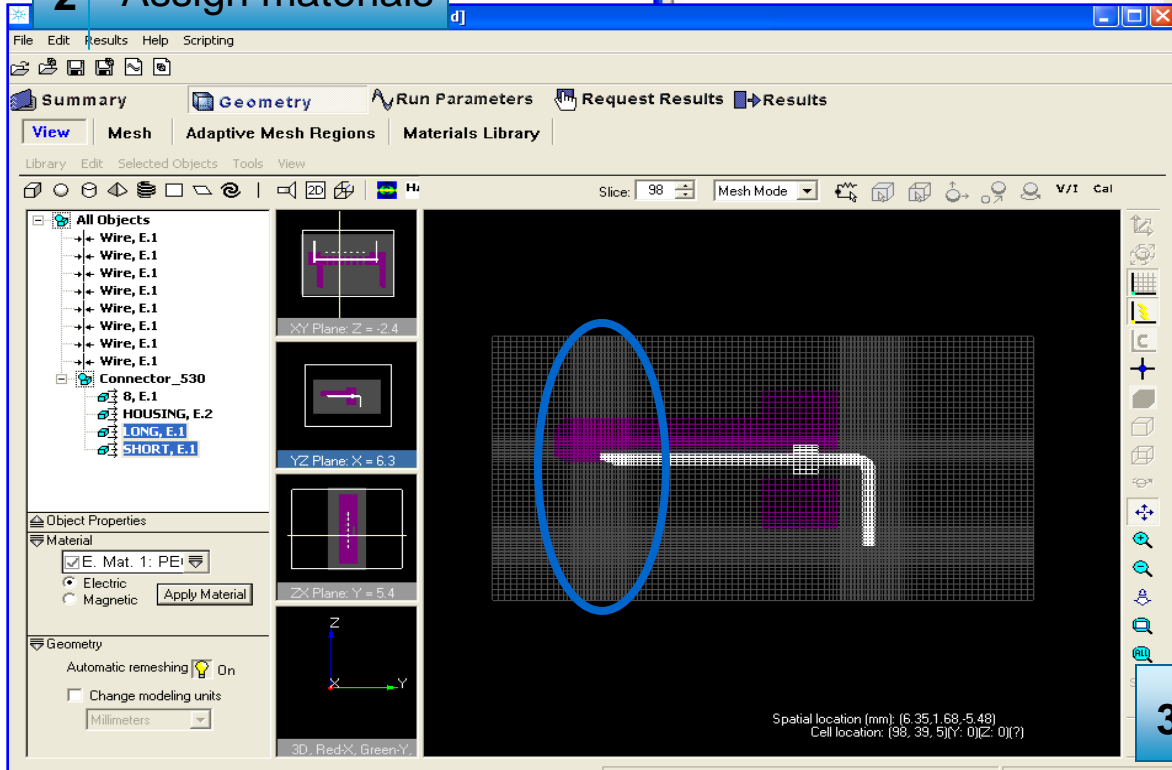
Pin positions (EMPro Import)

EMPro Simulation Steps

1 SAT File import in EMPro



2 Assign materials



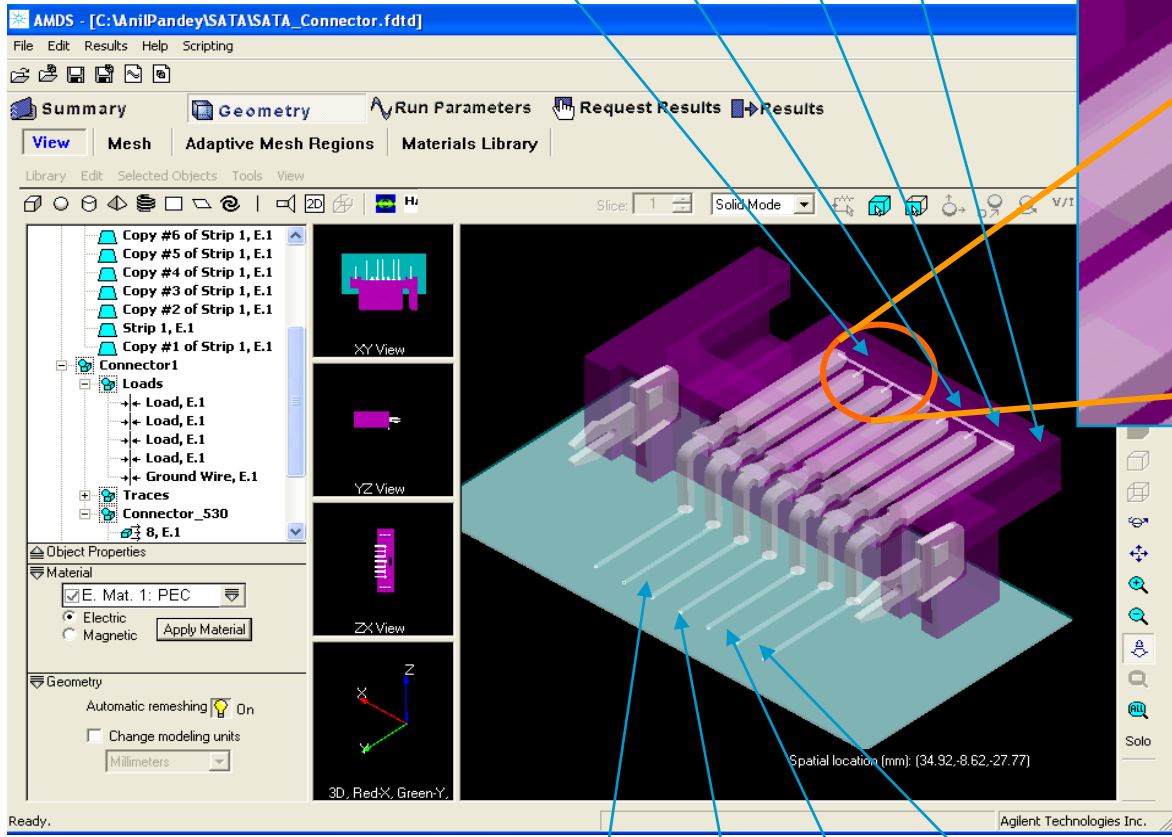
3 Define mesh

EMPro Simulation Steps Continued

Defining ports and excitation source

4 Ports

Port-2 Port-4 Port-6 Port-8



Port-1 Port-3 Port-5 Port-7

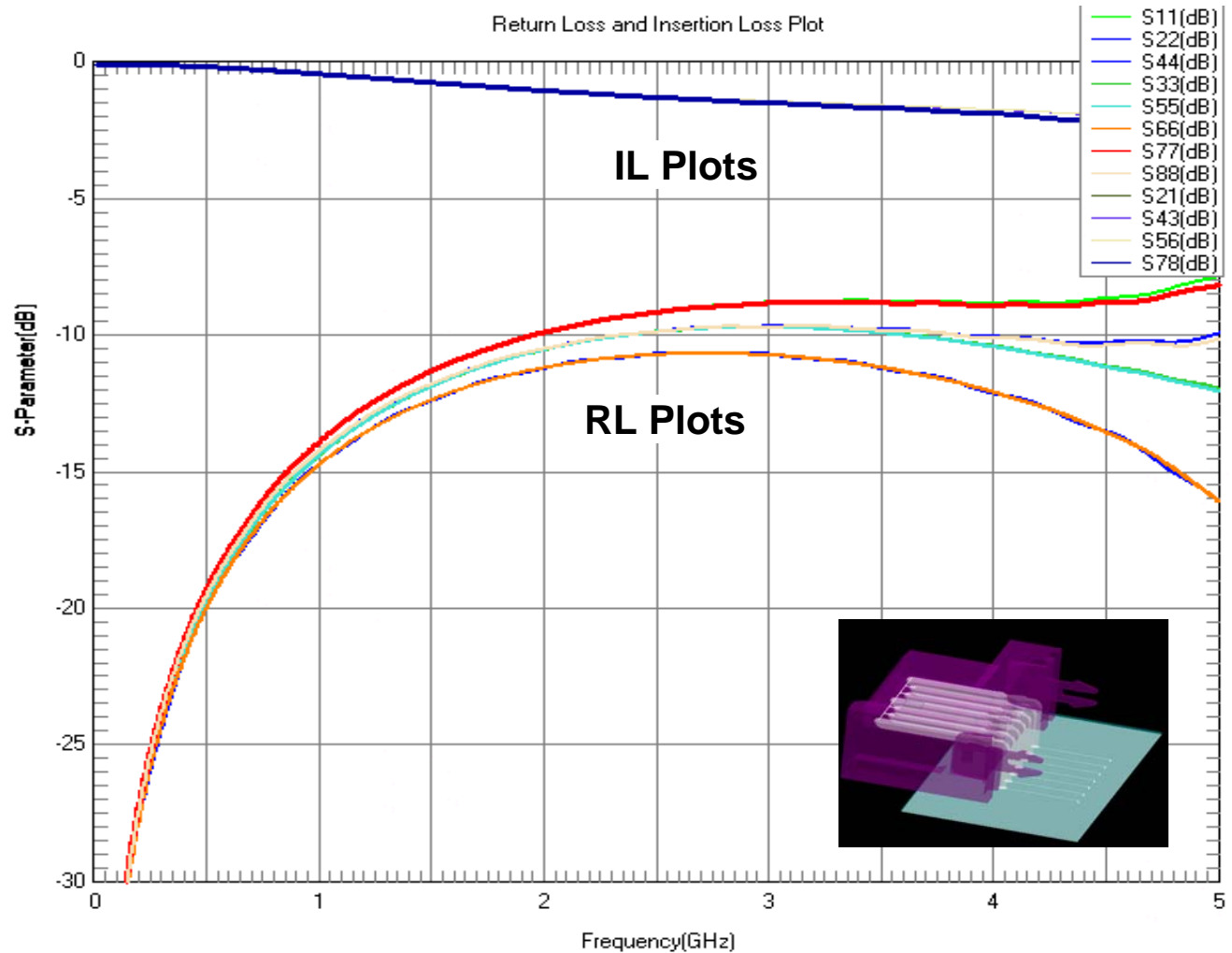
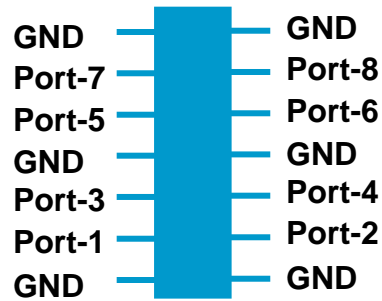
GND Voltage source Tx/Rx pin

5 EMPro Simulation

Simulate and view the result in EMPro

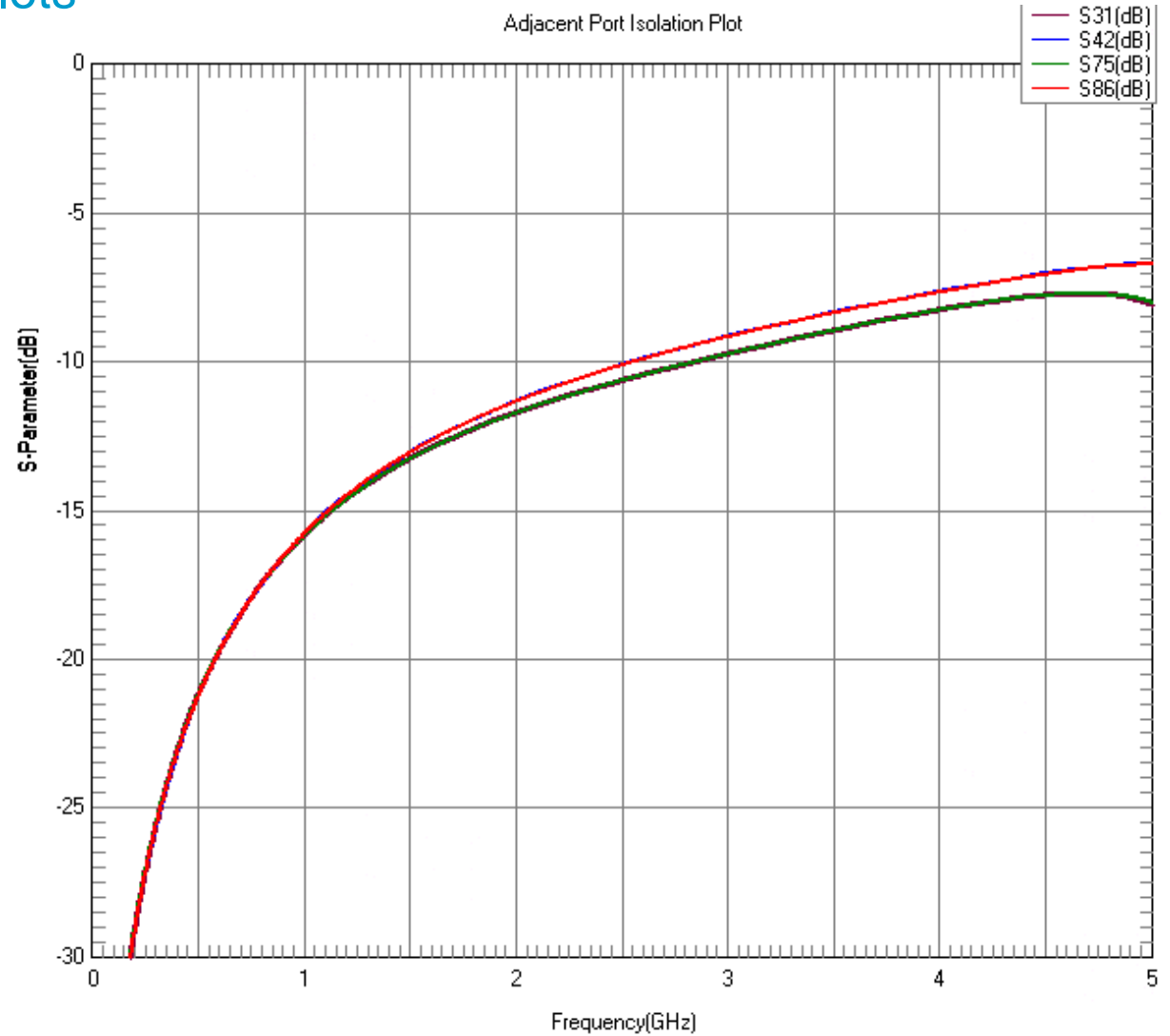
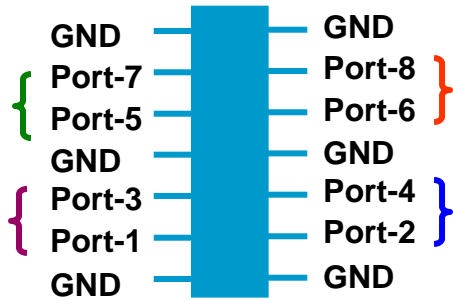
Simulated Results

Return loss and insertion loss plot

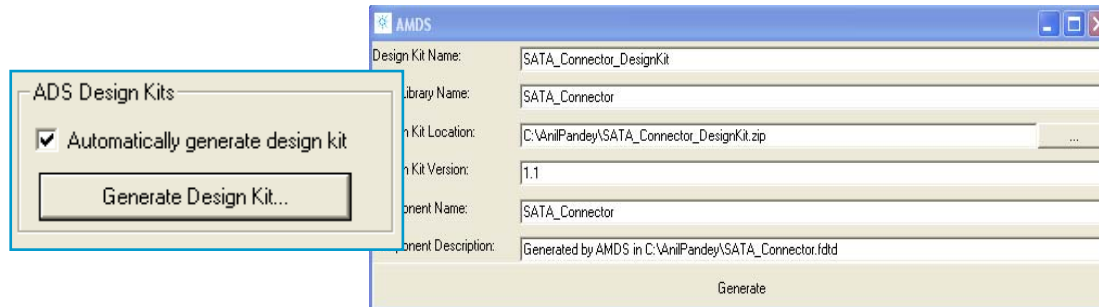


Simulated Results

Adjacent port isolation plots

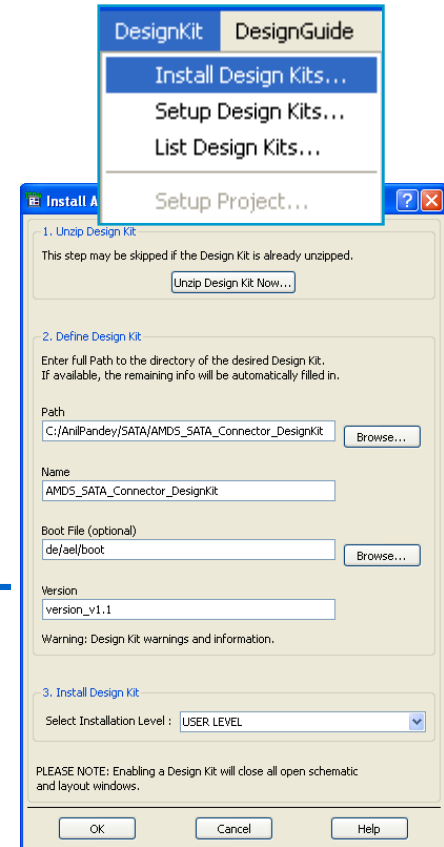


Creating ADS Design Kits Components in EMPro

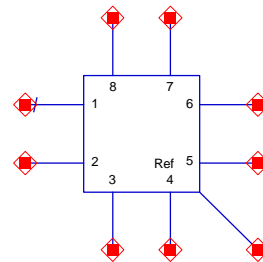
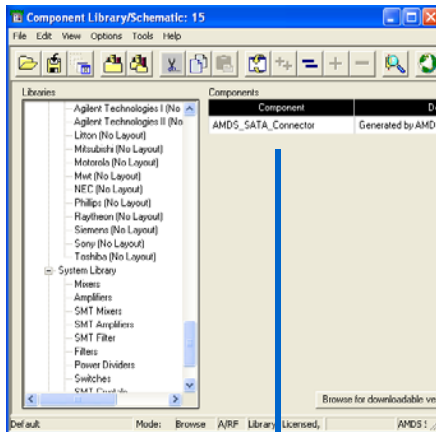


Generate ADS Design Kit (EMPro)

Install design kit in ADS



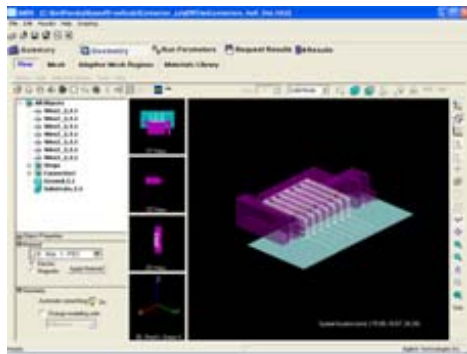
Select EMPro simulated Connector from ADS component Library



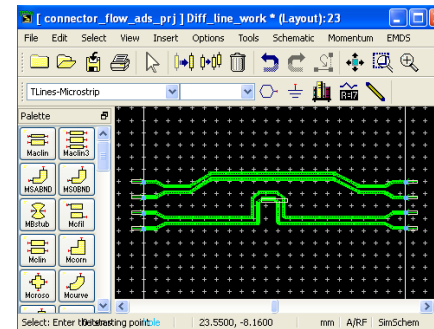
AMDS_SATA_Connector
AMDS_SATA_Connector1

SI Analysis along with High Speed Connector: Setup

High Speed Multi-pin
SATA Connector (3D EM-EMPro)



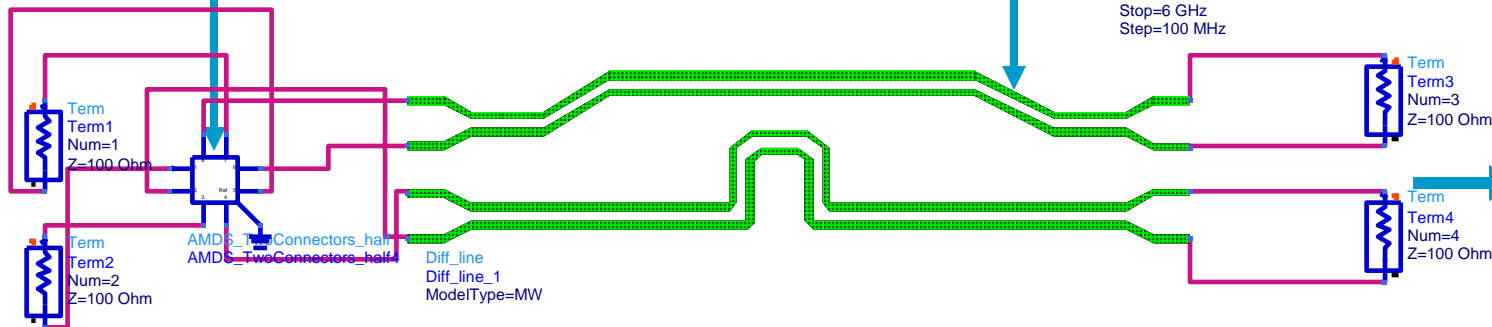
Board traces
(Planar EM - Momentum)



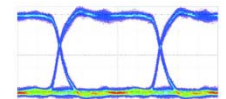
S-Parameter Simulation
Linear Frequency Sweep



S_Param
SP1
Start=0 GHz
Stop=6 GHz
Step=100 MHz



SI Analysis



EM Insights Series

Episode #7 summary

EMPro can give you early insight into possible interconnect design problems allowing you to optimize interconnects to produce best possible signal transmission.

Interested in learning more about this application?

- Request an [evaluation copy of EMPro](http://www.agilent.com/find/eesof-empro-evaluation)
<http://www.agilent.com/find/eesof-empro-evaluation>
- Request a [demo of EMPro](http://www.agilent.com/find/eesof-contact)
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