

Designing an OC-768 Package

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Outline

- Kyocera's Ceramic Technology
- Development of OC-768
- OC-768 Package
- Results
- Conclusion

Introduction to Kyocera

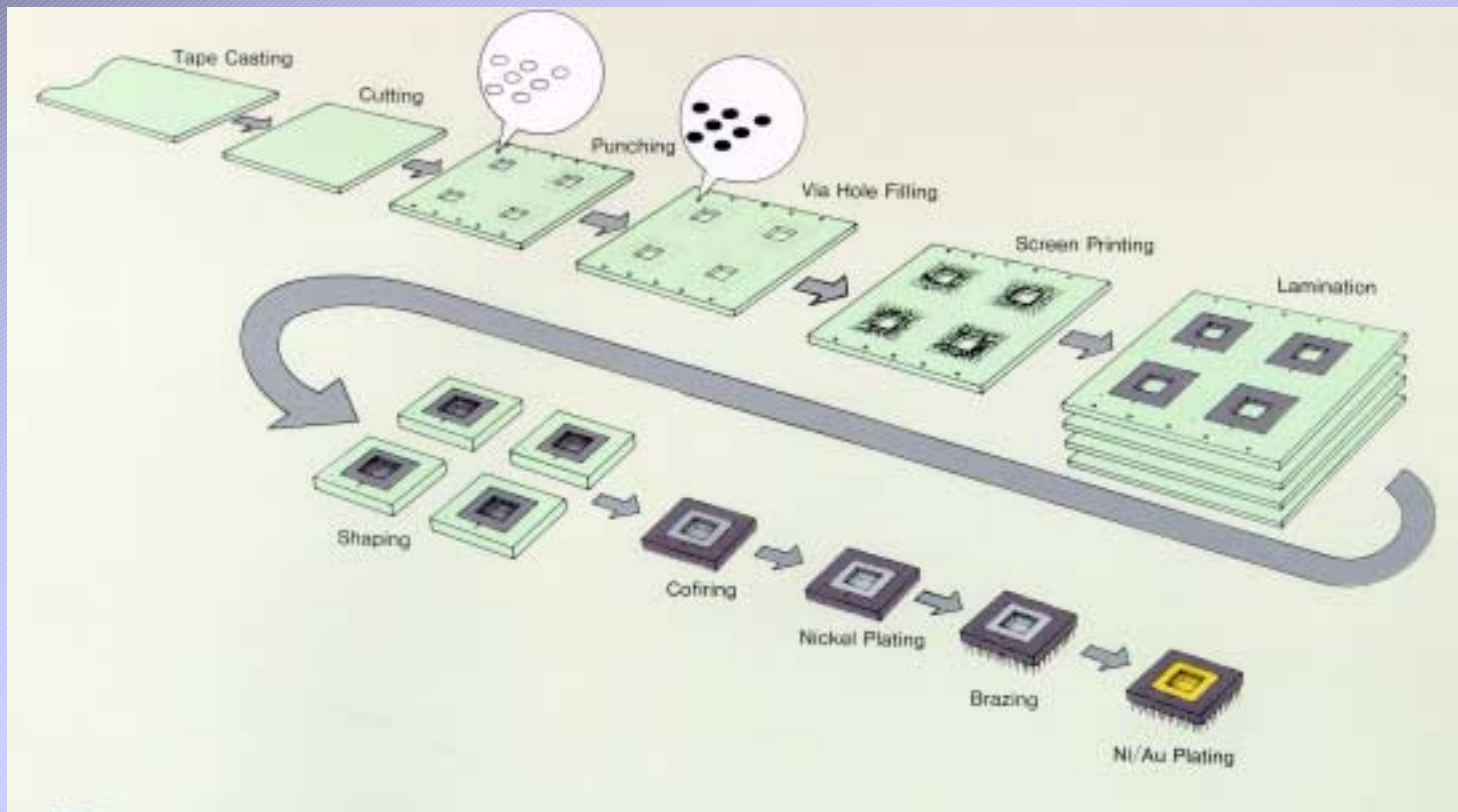
- Kyocera America Inc.
 - Owned by Kyocera International Inc. which is part of Kyocera Corporation.
 - Opened its San Diego plant in 1971
 - First Japanese corporation with production facilities in California

KAI's Products



Multilayer Ceramic Technology

- Benefits
 - Circuitry, Density, and Hermeticity



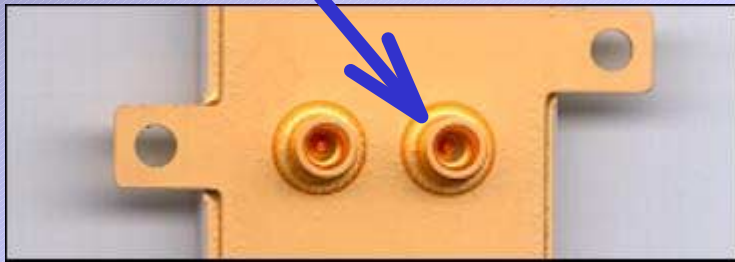
Kyocera's Ceramic Technology

- High Density Ceramic Module
 - Very fine spacing of via holes and lines
 - Multiple layers available
 - Tight dimensional tolerances
- Thin Film Technology
 - High temperature brazing
 - High reliability packages

Connectors and Leads on Packages

Ku-band Module

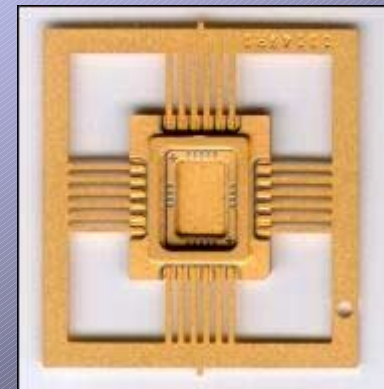
- GPPO High Speed Connectors



Pins for DC Connections

Leaded Packages

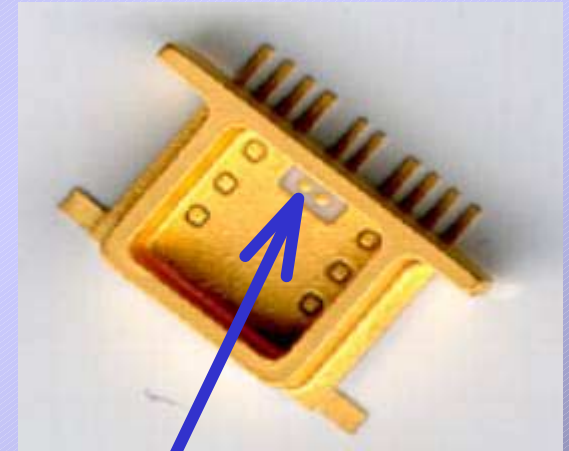
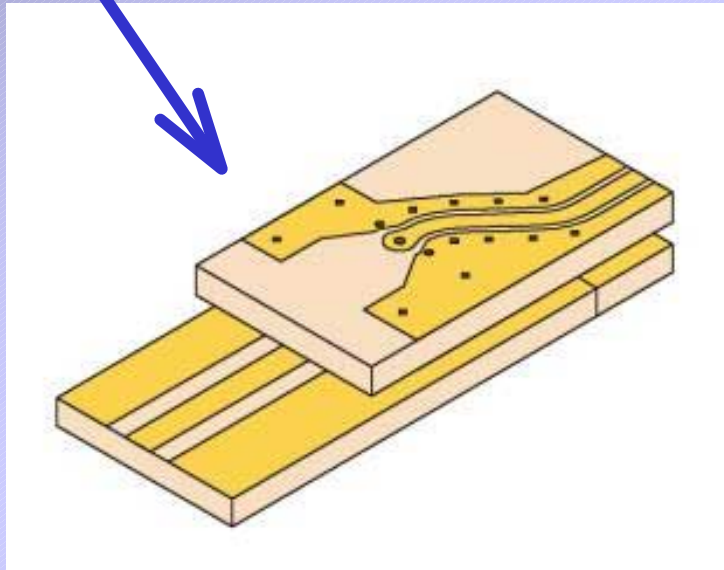
- Up to 10 G proven also.



Digital Package Styles

BGA

- Currently 10 Gbps
- Differential pair w/ground
- Flip chip or W/B die attach



Leaded Surface Mount

- 10 Gbps differential pair
- Coupled vias
- Signal through leads

Introduction to OC-768

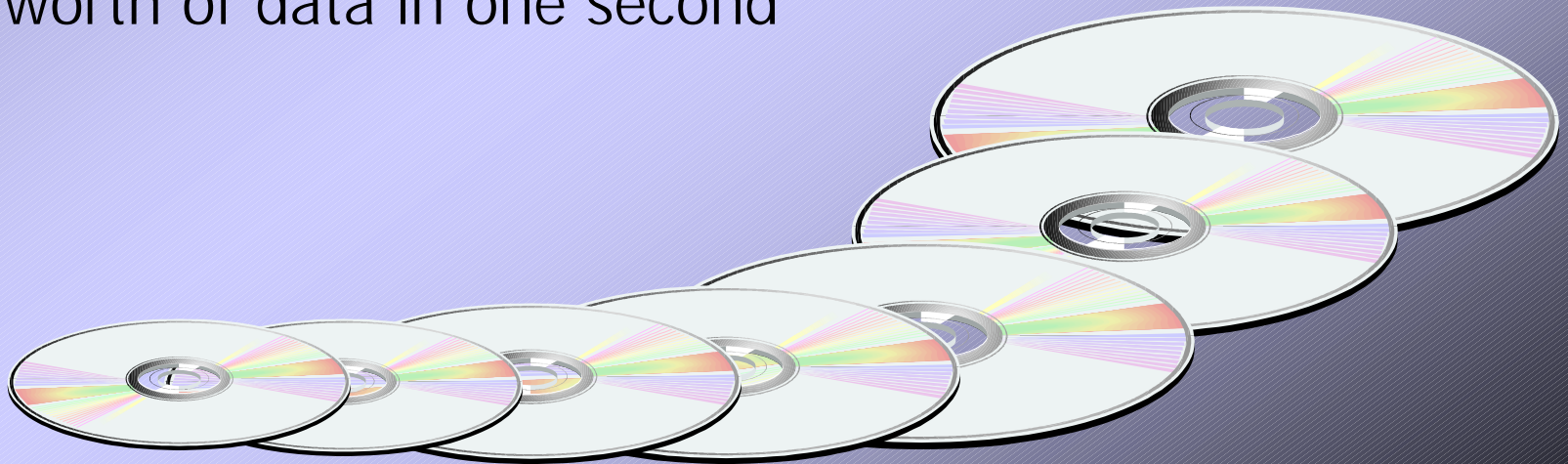
- Increasing data rates of digital devices demands...
 - High density
 - High performance
 - Short design cycle time
- Fast & accurate full-wave electromagnetic tool is required

Introduction to OC-768

OC	=	Data Rate
OC-n	=	$n \times 51.84$ Mbps
OC-1	=	51.84 Mbps
OC-3	=	155.52 Mbps
OC-12	=	622.08 Mbps
OC-24	=	1.244 Gbps
OC-48	=	2.488 Gbps
OC-192	=	9.952 Gbps = 10 Gbps
OC-768	=	39.81 Gbps = 40 Gbps

Development of OC-768

- Definition of OC-768 or 40Gbps
 - Fastest synchronous optical network standard rate for data transmission on optical fiber
 - Supports 40,000,000,000 bits per second on a fiber optic carrier
 - 40Gbps translates to the equivalent of seven CD ROMs worth of data in one second



Development of OC-768

- Challenges
 - Production capabilities
 - Sensitivity
- Successful Design
 - Meet design guidelines

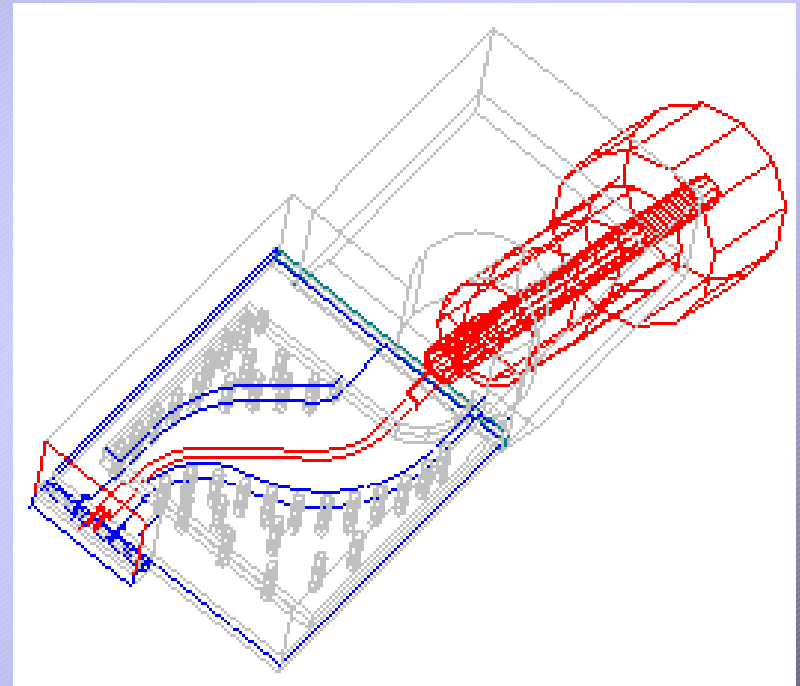


Approach to OC-768 Development

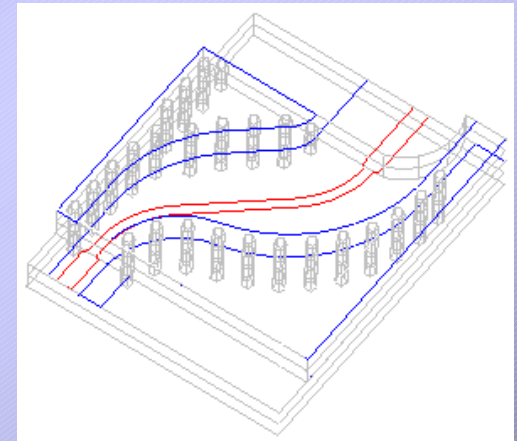
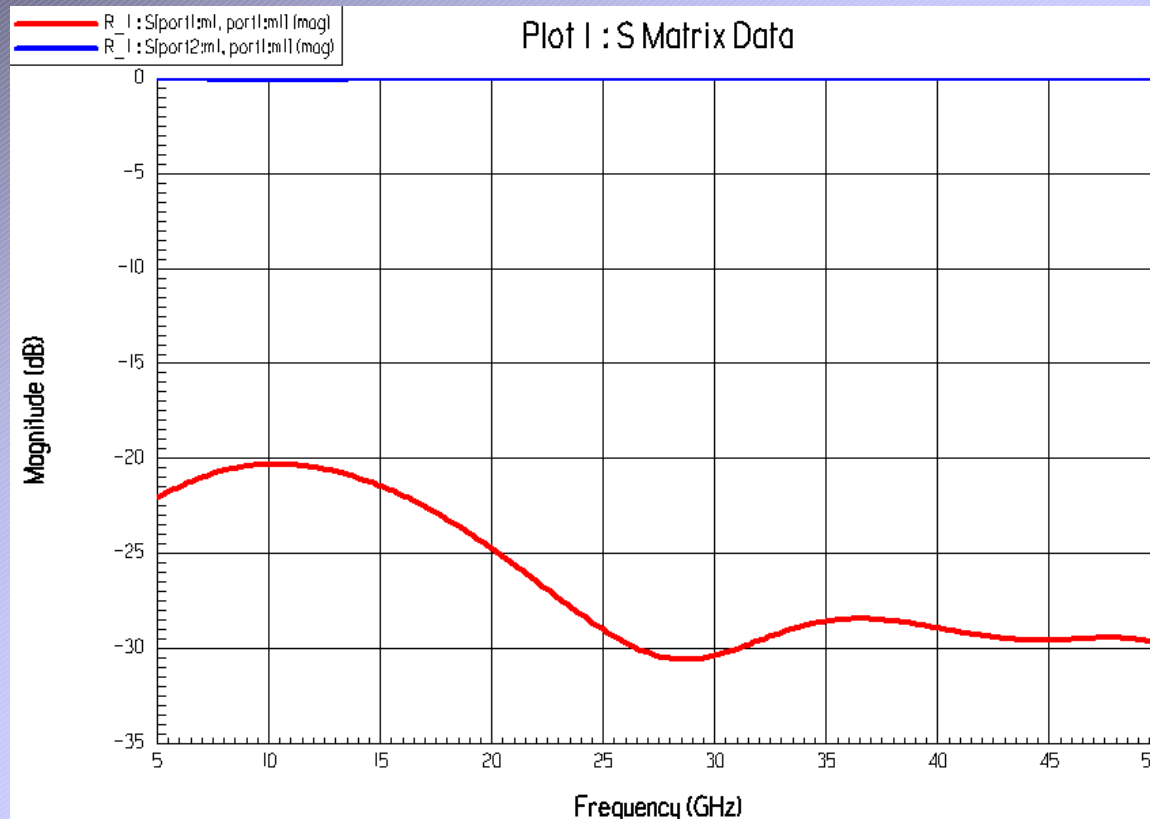
- Development
 - Initial design
 - Simulation & optimization
 - Build & test
- Development of Transition Technology
 - Connectors
 - Leads
 - Surface Mount
 - BGA
 - LCC
- Enhanced Electrical Characterization of Transitions
 - Computer Simulation Tools
 - HFSS & Full-Wave Spice

Package Components

- Investigated with HFSS
 - Microstrip/coplanar
 - Connector modeling
 - Model differential pairs
 - Gold plating vs. tungsten
 - Side metalization
 - Model circuit board
 - Leads and differential leads
 - Single W/B vs. double W/B
 - Wire bond pad optimization
 - Via placement
 - Determine rows of ground vias around the signal line

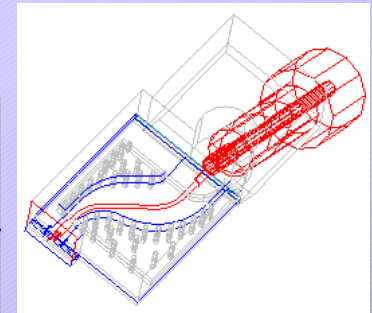
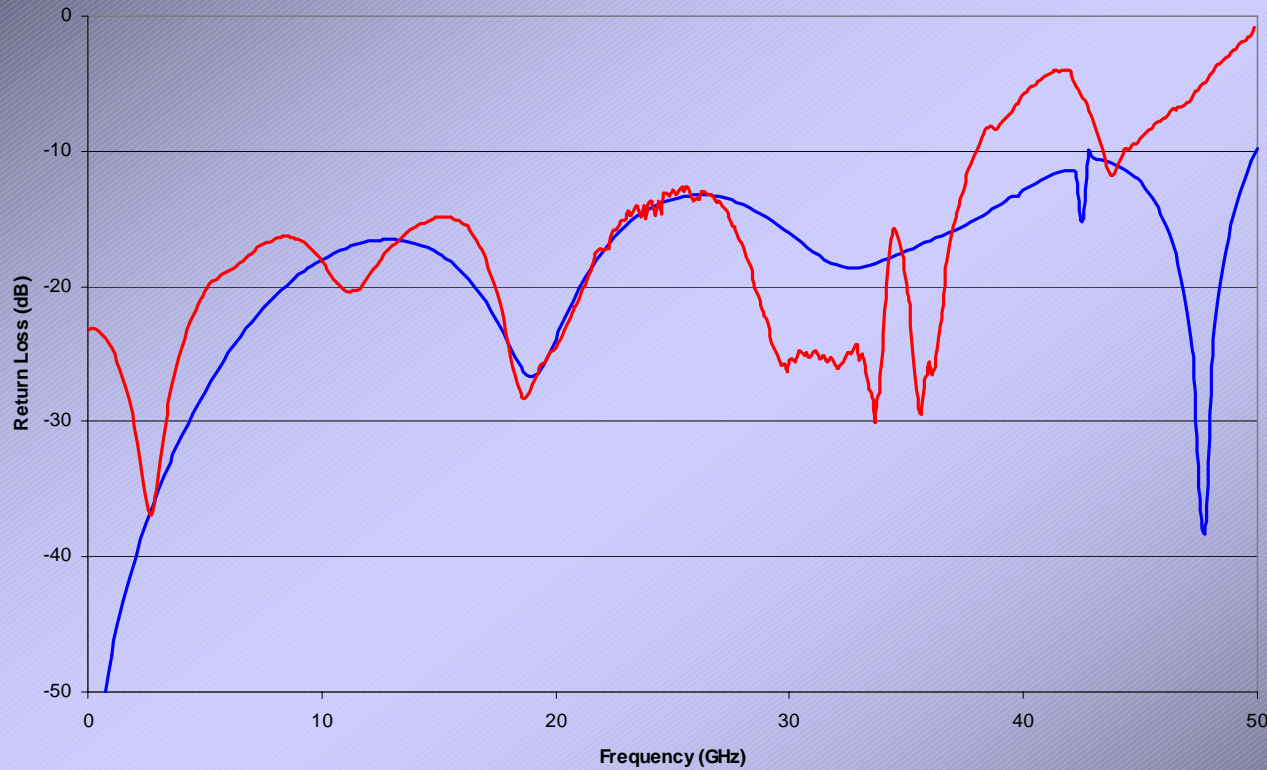


Simulation of Microstrip/Coplanar



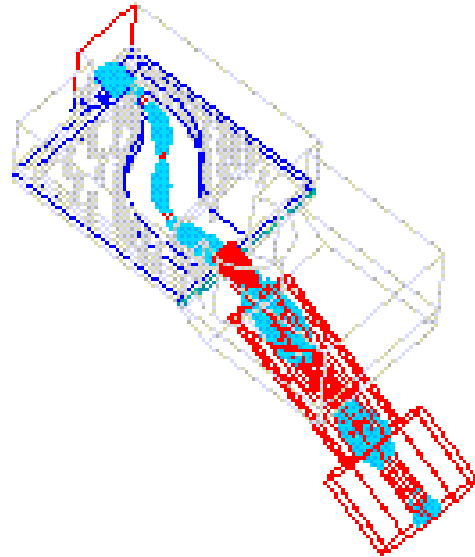
High Speed Line

Simulation vs. Measurement

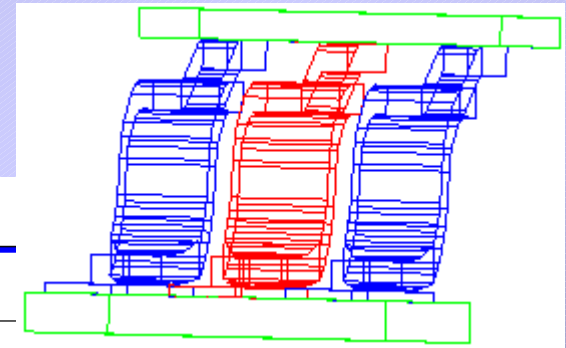
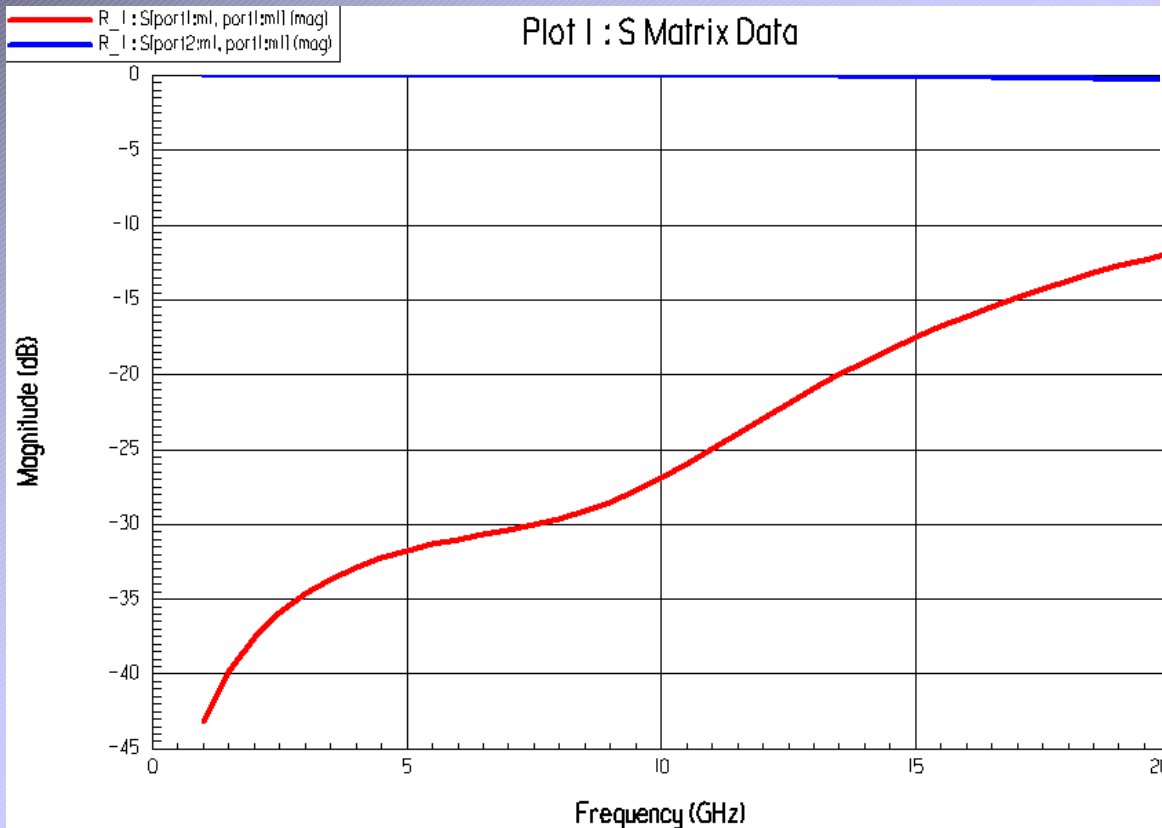


— Simulated
— Measured/smoothed

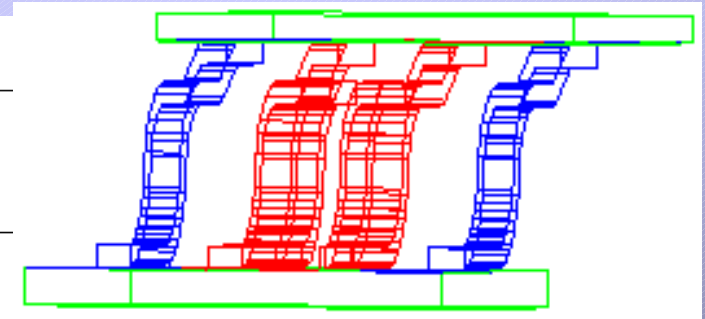
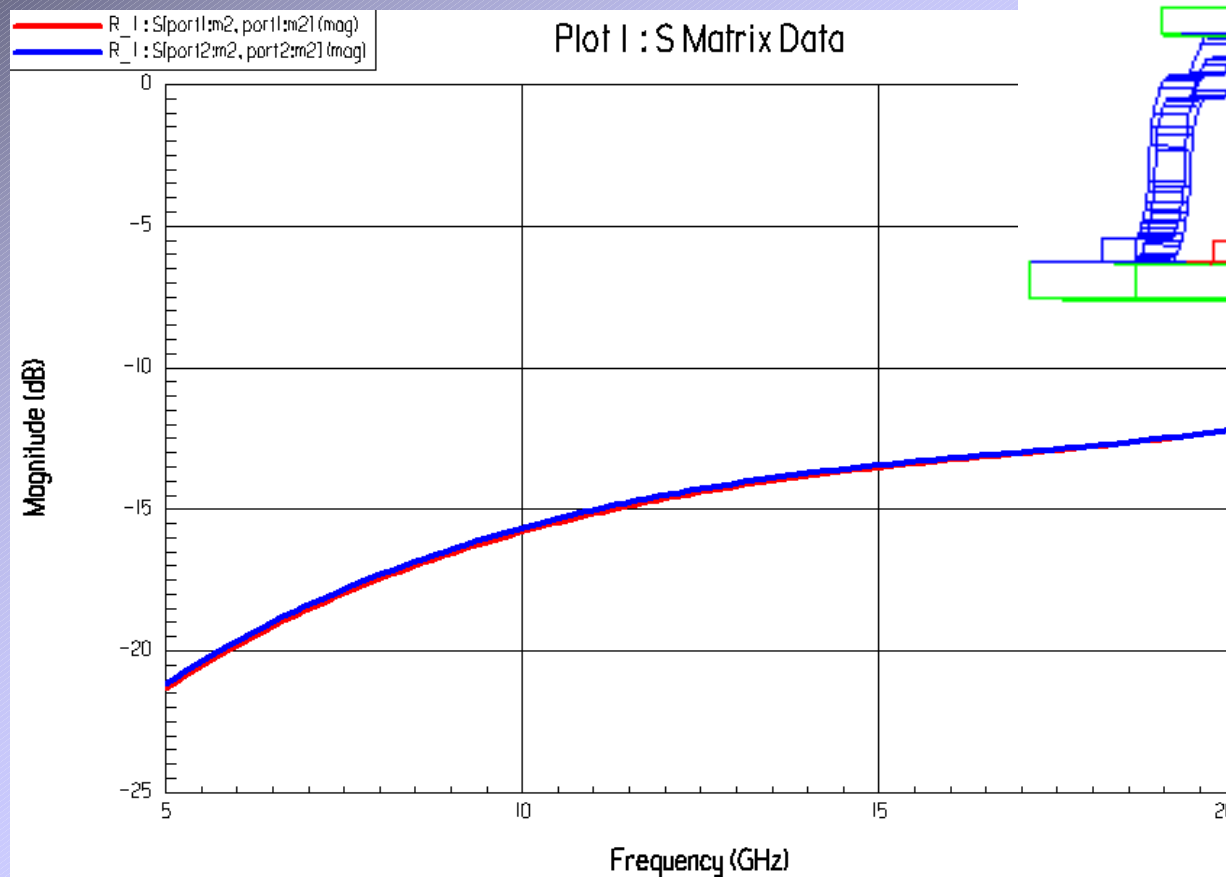
High Speed Line Animation



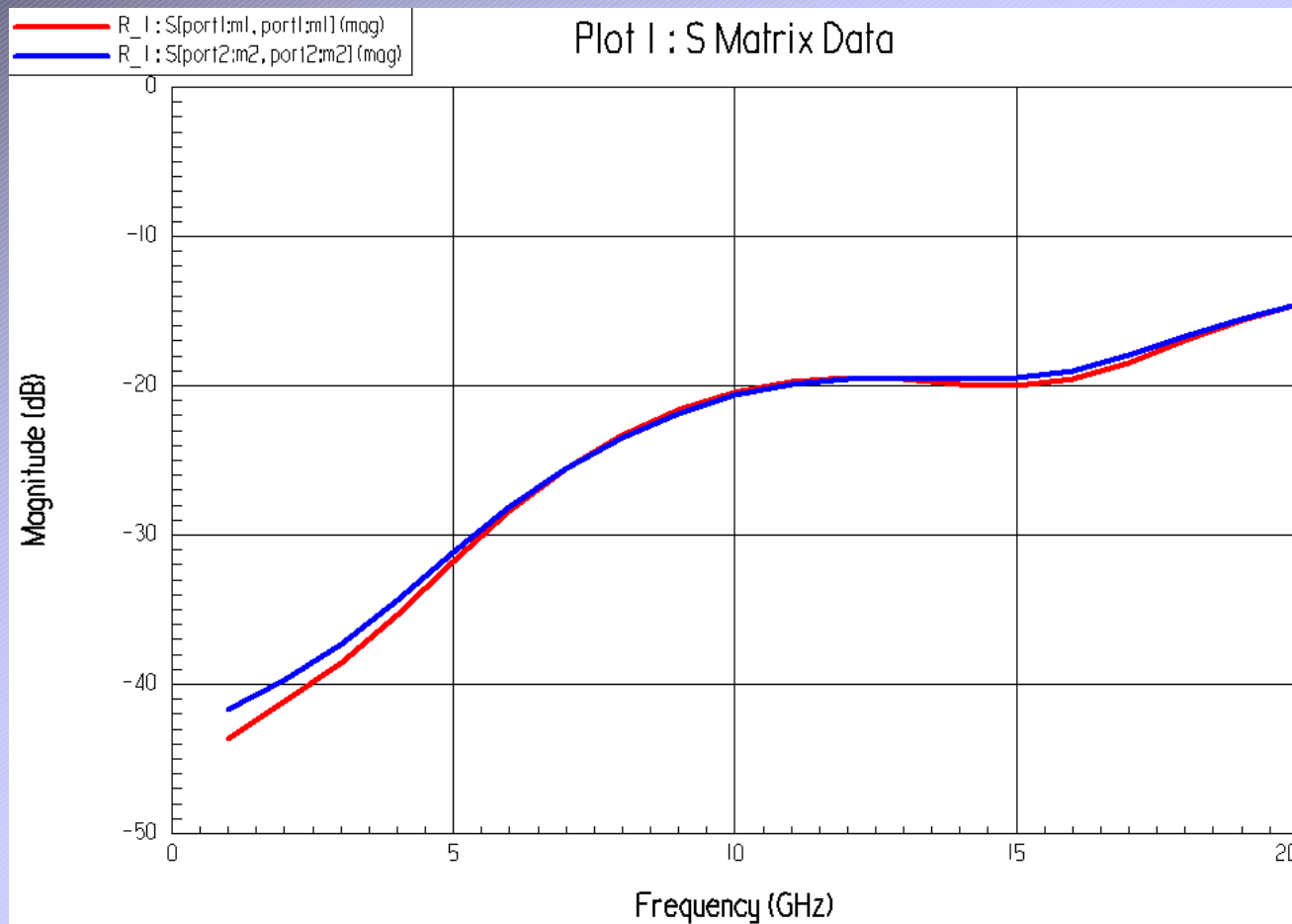
Coplanar Leads



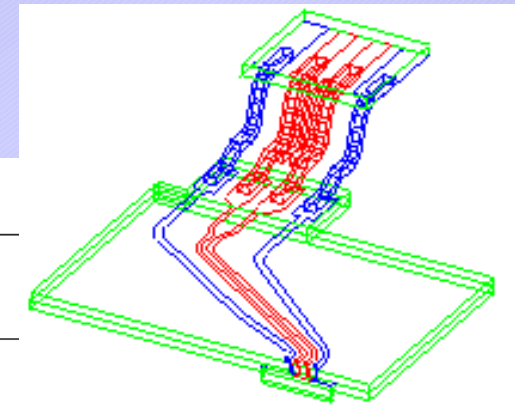
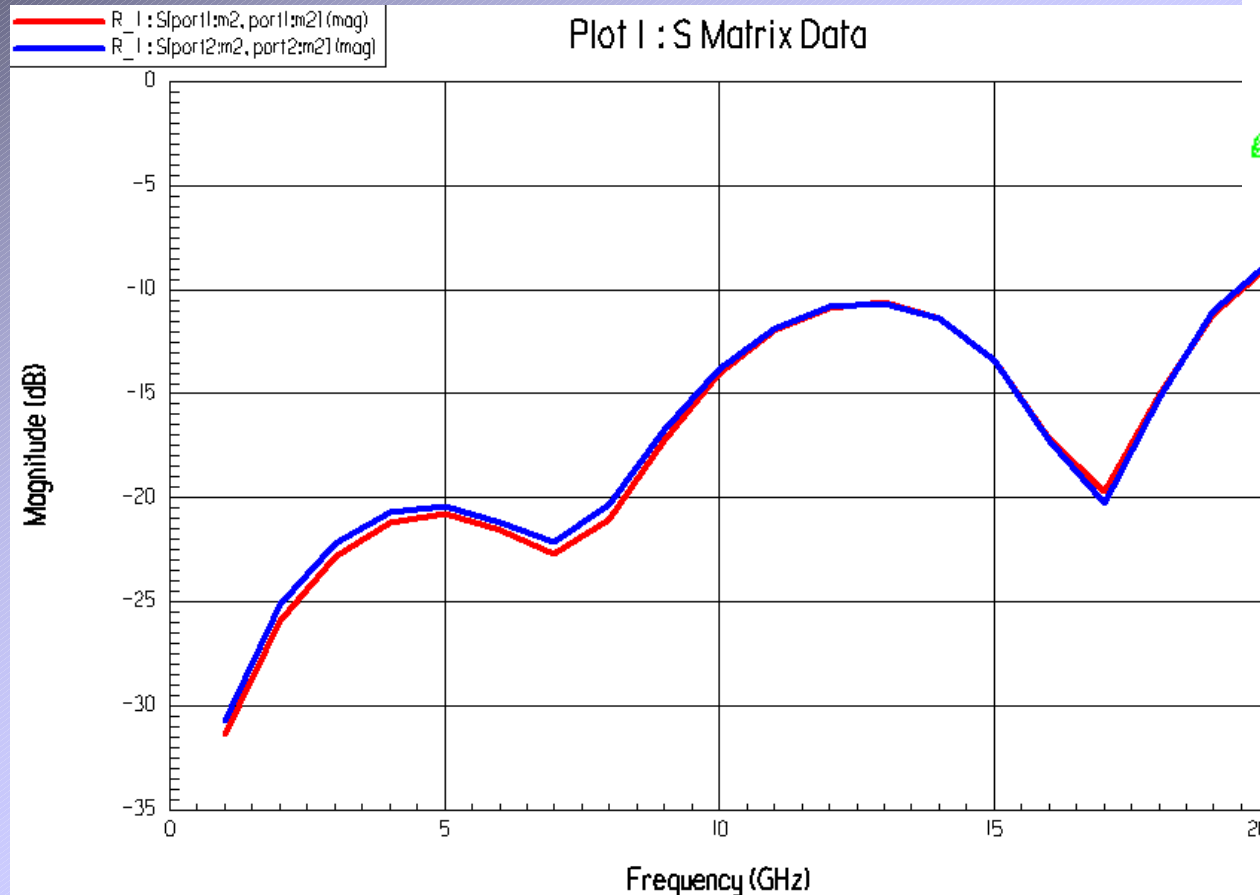
Differential Leads



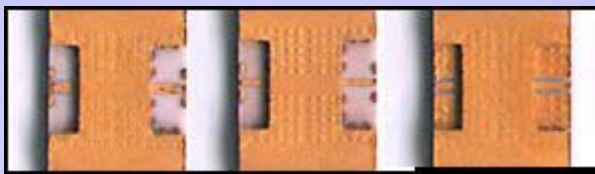
Differential Pair Lines



Differential Leads & Lines



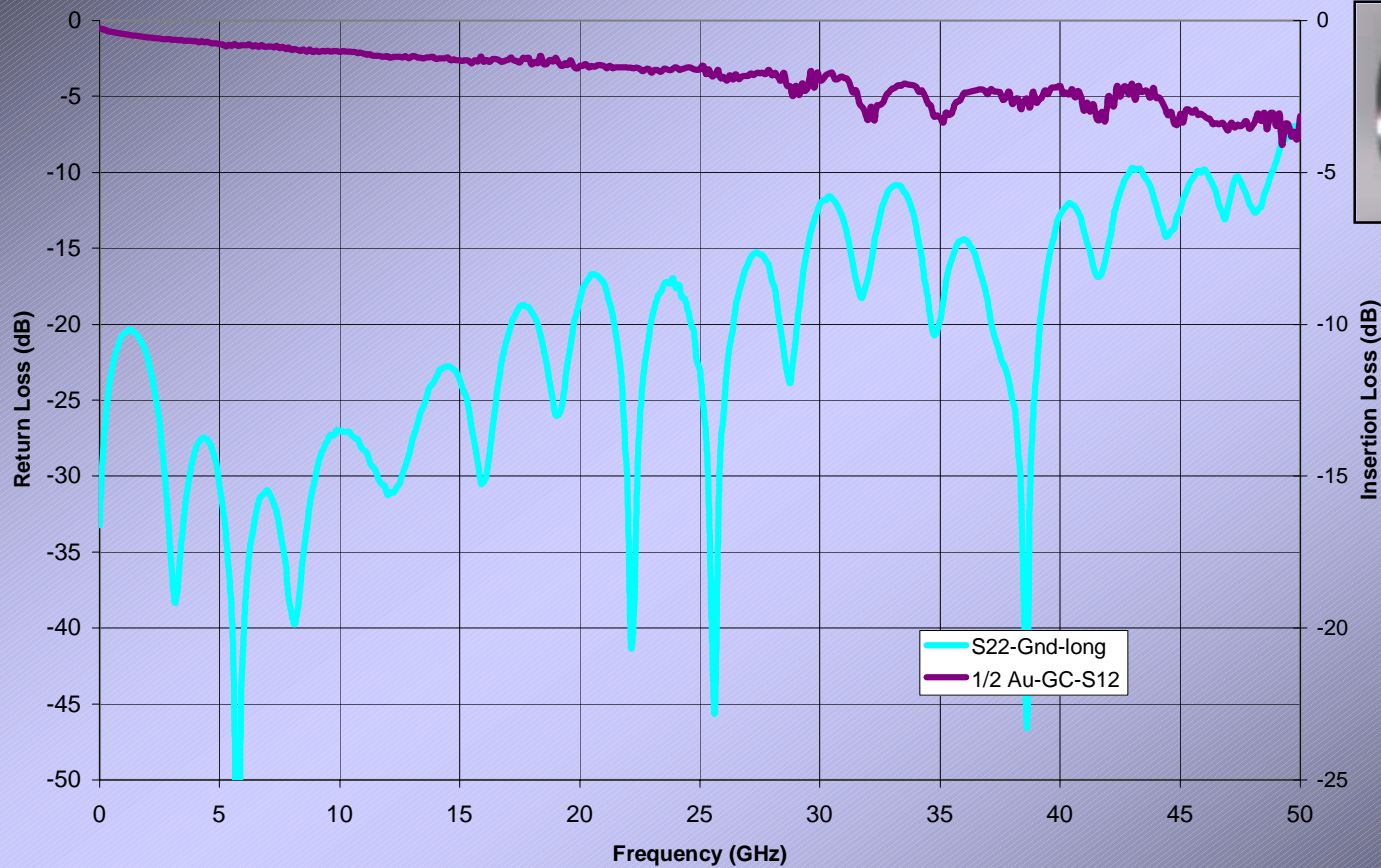
OC-768 Transitions



← Vispro LTCC
Transitions

40 G Data

40 G S22 and S12



Through data from longest and sharpest bends on the part

Conclusion

- Computer simulations enable
 - Design an interconnect over a required bandwidth
 - Characterize transitions
 - Extraction of circuit models
 - Provide customer with best technology for each application.
- HFFS is a powerful electromagnetic tool for modeling ceramic packages. It is absolutely necessary in the packaging world.